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Mobilization in Retrospect

Were There Lost Industrial Opportunities in the World War?

By Frank A. Scott*

IN ANY endeavor to appraise lost opportunities we must first define "opportunity." Just how are we using that word? Is an opportunity merely something which, if embraced, would have produced beneficent results; or is it also that group of objectives which, after the event, appear to have been attainable, but the seizing of which at the time was impracticable because of momentarily insurmountable and impassable obstacles?

In this field we have scope for limitless criticism and argument. It is the happy hunting ground of the easy-chair critic. Many an evening in my comfortable library—studying the ever-fascinating subject of the Civil War—I have ended the war in 1863 merely by having Meade at Gettysburg on the evening of July 3rd move forward from his left, and then, throw in his whole force from left to right, routing Lee's weary soldiers! Later, I have captured them all when the swollen Potomac held them on its north side for five hungry days. General Meade evidently recognized difficulties not so apparent in my library, which made my counterstroke too hazardous. Now, from that point we could develop an argument as interminable as eternity. Were the obstacles he thought insurmountable really so difficult? Did he recognize them then and govern himself accordingly, or were they discovered later and used by his friends to defend an omission? And so on and so on.

For the purpose of this discussion, I seem compelled to confine my comments to those things which, if performed, would have assisted our industrial preparation and which might have been attainable, but which either were not recognized or were considered and not adopted. In review, it may appear that my opportunity as chairman of the General Munitions Board in 1917 afforded limitless possibilities and that I missed some of them. That may be so. As I recall it, however, it seems to me that my first reaction was that there was a crying need for coördination, and instinctively I struggled for those procedures that would contribute to progress, and, much more important, avoid a descent into chaos!

Consider, seriously, just how we, as a nation, enter upon war. In countries where conscription exists and mobilization is a mere matter of order, the declaration of war is followed instantly by positive, nation-wide, thoroughly organized activity. In England and the United States it is very different. In our country our military services are restricted and governed in time of peace by numberless statutes which have no reference to war, and when war is declared, these limiting statutes are not automatically repealed. Consider in addition, if you please, that in 1917 war was declared on April 6th; the Selective Service Act was not passed until May, and the appropriation bill to supply funds for war contracts was not passed until June. Meanwhile, it was a penal offense for a contracting officer to execute a contract involving expenditures for which no appropriation had been made.

To buttress my own views, based on experience, at this point I give you the following from General Hagood's volume "We Can Defend America" (p. 173):

"During the years of peace we are afraid that somebody will take advantage of the Government—that is, munition makers, the trusts, the malefactors of great wealth, or even the Army officers themselves. We build up a hair-splitting system of administration and supply that befogs all of our war plans and involves us in such a tangle of red tape and impracticable procedure that the whole thing collapses the moment war breaks out."

THE war-time organization of 1917 was built up step by step, starting with what war-making machinery we had within and without the two military services. If you study its development, I believe you will decide that if there had been no Council of National Defense there would have been

THE distinguished author of this study was the chairman of the General Munitions Board and first chairman of the War Industries Board during the World War. His task was to mobilize American industry for its greatest emergency effort. The vision and energy with which the task was undertaken are well known to every student of industrial preparedness.

Here are recounted, perhaps for the first time, the views and purposes of the man who bore the responsibility for mobilizing the first phase of our munitions preparedness. The lessons of this undertaking are here reviewed in the light of twenty years after, and their application to any future war effort is presented objectively. We sincerely believe this article by Colonel Scott to be one of the greatest contributions to the new concepts of national defense and we recommend its careful consideration to all readers.—EDITOR.

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no General Munitions Board; if there had been no General Munitions Board there would have been no War Industries Board of July 1917; if there had been no War Industries Board of July 1917 there would have been no War Industries Board of March 1918. Each of these forms of organization led by process of natural development into the next, until we secured the ultimate then attainable.

Our steps in the next emergency may be fewer and require less time. Those who think the country could have stepped from peace into the developed War Industries Board of 1918 can perhaps visualize a baby stepping out of its crib in the form of a middle-aged man complete with gold-filled teeth and spectacles!

There was one purpose underlying the organization of the General Munitions Board which should be emphasized if we are to appraise justly the value of its work. While, primarily, it was to coördinate the activities of the various departments and bureaus of the two military services, it also was designed to keep the work of those bureaus from bogging down because of the rapid increase in volume, or from becoming so chaotic that some other general form of organization would be demanded by the country. The theory, which turned out to be true, was that if the departments and bureaus were given help from the outside they would gradually strengthen themselves by accretions of Regular officers and Reserve officers, and later by additions of powerful civilian help which would enable them successfully to meet the strain imposed by war conditions.

The natural alternative was the organization of a great civilian munitions ministry such as England was forced to adopt, and this meant relegating to an obscure position the professional organizations upon which we depend in peace time and which must always be the nucleus of military technical knowledge and experience in war time. We all know, now, that the procurement branches of the two services bore the strain and emerged intact. When the War Industries Board came into power, it did not supersede the military organizations. It quite naturally found its functions in broader fields than those occupied by either the Army or the Navy procurement branches. It became, in fact, a supercontrol body governing national industrial activities at the time, whether of war or peace.

MANY of the desiderata of war-time organization or war-time policy, which we now wonder were not then immediately recognized, adopted, and applied, involve the problem of war psychology. They were too far ahead of the public thought and feeling to be instantly imposed even by a popular war-time government. One of these was controlling the prices of essential commodities. Everyone in authority recognized that the supply of essentials was bound to be less than the demand. The effect of this on prices was obvious. The ideal thing would have been to peg prices where they stood. Immediately collateral questions arose: how about goods which involve imported elements, such as rubber, manganese, etc.? How about our Allies—are they to be granted the same scale of prices as our own Government and people? And so on and so on.

Conceivably the war powers of the President were broad enough to have covered such action if he had deemed it vital to the winning of the war, but it involved our entire financial structure. It would dislocate many parts of the economic machinery. It would throw Congress into a difficult situation in relation to the interests of constituents. It would, academically, have been the proper course; but it was more reasonable, more statesmanlike, and in the end more influential toward success in the conflict to move slowly enough to secure the same result in coöperation with producers after the war spirit had spread sufficiently to prepare the people to make sacrifices.

We did, eventually, recognize the stark necessity for price control. There was no law nor machinery for it. It is, as I have said, an exceedingly sensitive subject and one difficult to cover by statute. History proves it cannot be accomplished successfully through a long period. Yet in war it must be undertaken. Here again, if you study the record, you will see that it passed through a process of development. First came a representative committee of the Council of National Defense headed by myself as chairman of the General Munitions Board; next, a series of coöperative movements of larger industries—lumber, steel, etc.—the General Munitions Board acting under the war powers of the President; and then a definite policy and organization under the War Industries Boards of 1917 and 1918 also acting under authority of the President. We would have been the more justified in being drastic by our knowledge that any system established contrary to law would fall at the declaration of peace. We must not, however, overlook the fact that the statutory authority limited our discretion to "fair and just prices." Demand and supply could not be ignored at the outset in interpreting those words.

It may sound iconoclastic, but my personal view is this: It is as impracticable to consider eliminating profit from industry at the beginning of a war, in a democracy such as ours, as it would be by fiat to provide that the war should be fought without anyone becoming too hot or too cold, or being allowed to go hungry or lose sleep. The only effect of an effort to peg prices of material and labor at the outset of war would be seriously to disadjust the entire economic structure, lead to an incredible amount of chiseling both by capital and labor, and to the extent that these things would delay progress, menace the possibility of ultimate success. How could we enforce such a system without having either, first, established a spirit of coöperation or, secondly, provided some means of policing labor, industry, and commerce?

You will discover it is always an advantage to fight only one war at a time; and, as I see it, to take on a fight with an enemy people and our own people at the same time might prove burdensome.

THE need for establishing priority between the various departments and bureaus, and between the two services, was immediately recognized and quite effectively determined and enforced. We did not, however, undertake to enforce it as between war requirements and ordinary civilian needs until after the establishment of the War Industries Board in July 1917; and it was not thoroughly enforced by adequate organization until after the establishment of the War Industries Board of March 1918.

As I see it now, at the outset we were too considerate of civilian industry. Perhaps our thinking was clouded by England's early motto, "business as usual." But, whatever the explanation, the proclamation on "essential industries" should have appeared earlier, and priority, based on that definition, enforced so far as necessary to expedite war requisi-

tions. The decree of Revolutionary France in 1792 should have been our guide: "All France, and whatsoever it contains of men and resources is put under requisition."

President Wilson would have been justified in issuing that decree in the United States in April 1917. It stated the fact and the probable need, but, politically, it was difficult, perhaps impossible. Our people had not yet awakened to the significance of war. It took months before the American public really absorbed the fact established by a declaration of war; namely, we had but two alternatives of which only one was thinkable—peace with honor—or defeat!

The industrial procurement program was aided by the decentralization obtained by dividing the country into procurement districts. This might have been accomplished earlier if we had possessed the personnel. Here again, war psychology was an important factor. At the beginning, dollar-a-year men were still too involved in their own affairs to respond as they did after their relatives and neighbors appeared in uniform.

We may be charged with deliberation in the establishment of the War Credits Board and the Capital Issues Commission. When we review the occasion, it is obvious that private capital and credit alone could not bear the burden of war expansion. We first encountered the problem in making the contracts for rifles in May 1917. To have acted more promptly, or to have anticipated, conceivably might have been better, although I have no evidence of actual disadvantage to our program. But here again, we face the fact that no objectives had been stated. How could we plan in detail until we knew the problem? Even the President was probably uncertain as to just where and how to apply our force, until the situation created by America's entry clarified itself enough to determine strategical objectives.

ONE omission may have related to the use of publicity. We may have had an exaggerated idea of the harm it would do our cause to have enemy countries informed of our preparations, or our own people disappointed by overoptimistic prediction. We, therefore, gave comparatively little to the press. Our program might have been reversed. Perhaps one way to break the enemy morale was to emphasize, even exaggerate, the spectacle of America "rolling on her foe." We had the men, money, material—why not let the world know we would have a million and a quarter additional rifles by the end of the first year; five thousand guns from three inches up within sixteen months; artillery and small-arms ammunition without limit; four and a half millions of men, and so forth? It certainly would not have been likely to "give aid and comfort to the enemy." Instead, we adopted a policy of silence; we did not tell the world much about what we were doing, and we retained our attitude of proud silence even when the world, because it was uninformed, proclaimed that we were not doing anything. Now, as a matter of fact, no unprepared nation in the world's history ever took care of its allies and at the same time armed and equipped itself as promptly as did we. Yet, while we were right in the midst of the program, a great national figure, an ex-President, came out in a contributed editorial on "Broomstick Preparedness." Were we too timid, too modest, too sensitive of the appearance of vainglorіousness? In addition to all our other "experts," should we have had at least one P. T. Barnum? Ponder this however: two subjects certainly received ample publicity—aircraft and standardized motor trucks. Was that helpful or harmful? Were the enemy disturbed and our own people encouraged?

Industrial mobilization bears a strong resemblance to the conduct of armies. When action has been decided on in the field, plans made, orders issued, and the troops put in motion, there is little a commander can do until contact is established and the action develops. It is merely for him a period of anxious waiting. Similarly, in the preparation of munitions, after specifications have been decided upon, quantities determined, contracts made, there is a period of time during which material, men, and machinery must be assembled or redistributed; jigs, tools, and gages manufactured; and during this period, to the inexperienced, nothing seems to be happening, no finished article appears. It is while we are in this dead water and before the current of apparent progress is evident, that it is essential to maintain the interest and enthusiasm of the public by properly directed and sufficiently restrained publicity. Old-fashioned people will remember that in the country, when the minister stopped in unexpectedly for dinner, after direction had been given that the family rooster be decapitated, scalded and plucked, and before it appeared as a chicken stew, there was little for the farmer host to do but endeavor to sustain the flagging hopes and anticipations of his guest.

Should we consider the possibility that we might, by too much publicity, even start a rivalry between departments or individuals which would create newspaper reputations not based on either efficiency or accomplishment, and yet with a degree of public support that could prove embarrassing? Without going outside our own history, we can recall Generals Gates and Wilkinson of the Revolution, and General Butler of the Civil War. Did their accomplishments justify the degree of acclaim and public confidence which their publicity programs produced? Did their temporary popularity aid the cause or did it injure more efficient officers who were not good advertisers?

I HAVE studied the program published by authority of the Assistant Secretary of War, entitled "Industrial Mobilization Plan, Revised 1936." It evidences much painstaking study and labor, and the organization plans and outlines will, without doubt, save time and avoid waste of energy and much working at cross-purposes in the next emergency. To be of greatest service, of course, it should be kept flexible in certain of its sections, until the nature of the problem and the means available are known.

I venture to quote a few sentences to show you how the opinions expressed in this document are at one with opinions, formed from experience, which I had written into this discussion before I read the Mobilization Plan: "Army and Navy procurement planning must be coördinated. . . . Plans must be practical rather than theoretical. . . . Emergency measures become effective primarily through the support of public opinion."

If it is anticipated that in this discussion I will undertake to set up an ideal organization to direct and control industrial requirements for the next war, I must relieve that expectation. I am not even thinking of that approach to the problem. So far as I know, the simple formula of growing warriors by the process of sowing dragon's teeth became obsolete some time ago. War, now, is just a bitter business to be driven with incredible force and velocity, but still just a business, controlled and limited by its resources; handled

wisely or recklessly by its management, and succeeding in the end by reason of vision, courage, and industry directed by common sense.

Assuming I am right, we will enter the next war from the platform we then occupy—as we did the last—and that platform will be formed of the laws, military procurement agencies, customs, and prearranged system as then developed. We will never spring full-armed from the brow of Jove. We seem able to do that only in the books written after each war by the wise, silent ones, who, while we make our first struggles, stand by with pencil and notebook to record our ungraceful antics. Doubtless there were many shortcomings in our early war organizations; but if I had to cite only one subject which would have contributed most to progress, I would say it should have been a definite statement of our first over-all requirements, giving principal items, approximate quantities, and the time schedule desired. I have been told in recent years that such a table existed. If it did, it was well hidden; for during the first ten months of strenuous endeavor I never heard of it. In its absence, our attack was piecemeal, as is the case with green troops.

That cannot be charged to anybody. It is Uncle Sam's way of casually getting into a big day's work. We pinch and starve our military services in peace time and then, in a war emergency, expect them to pick results out of the blue. It is the way of all unarmed nations, conspicuously England and the United States. Personally, I would not change it if the alternative had to be a nation armed and prepared for aggressive warfare. However, there is a sensible, safe, and economical middle course which our people should be encouraged to take. The Office of the Assistant Secretary of War is making a notable contribution toward this end.

THE National Defense Act with broad powers assigned to the Assistant Secretary of War, the division of our country into procurement areas organized by departments with a definite assignment of available facilities, and many advances in the detail of organization, will help us in the next emergency. Even so, take my word for it, you will be astonished to witness the improvisation that will still be demanded and the crying necessity for coördination as soon as the machine starts to roll.

Will there be a complete and prompt determination of requirements as to design, quantity and priority? Will Navy requirements be coördinated with Army requirements from the outset? Plan as well as we may, we will still be forced to improvise. "For war, least of all, conforms to fixed rules, but itself in most cases has to form its plans to suit the occasion as its own resources allow" (Thucydides, Chap. 122, Book I). The quotation sounds quite up to date, but it was written in approximately 420 B. C.!

The principal reason for our inability to plan the next war probably rests in the very nature of war. It demands such expansion of thought, such superhuman expression of thought in action that adequate plans made in peace time, or at the beginning of a war, would seem fantastic. So, in peace time, we are really never making adequate plans for the next war; we are merely replanning the last war in the light of that experience, plus a part of the general progress made in the meantime. One thing to ponder is the fact that after appraising all the accomplishments of war time and the possibilities of the future, we have provided a piece of organization machinery under the Assistant Secretary of War and the Army and Navy Munitions Board, which closely resembles the old War Industries Board and General Munitions Board of 1917.

In 1917 we had to begin with the organization machinery we possessed. This consisted of the procurement branches of the two services, the General Staff, the war powers of the President, and the rather tenuous powers existing in the Council of National Defense—the latter proving to be a godsend, however, when used in conjunction with the other groups of established authority. We never can be too thankful that the President, the Secretaries of War and Navy, the Director of the Council of National Defense and the representatives of the General Staff were all men of such vision and flexibility as to respond quickly to the demand to stretch thin authority to its elastic limit to enable us to make headway promptly.

The quickest and surest method was the one adopted—the establishment of a General Munitions Board by order of the two Secretaries, composed of officers delegated and authorized by the heads of departments of the Army and bureaus of the Navy, including also certain skilled civilians, thus preserving and uniting in one coördinating body all authority of law and Presidential war power.

IF I should, in justice, say a word in defense of the General Munitions Board of March 1917, before concluding my subject, it would be this: We should not expect men, suddenly charged with the duty of organizing industry for war, to visualize their task on a scale larger than the war itself. Therefore, let us all be reminded that in May 1917 even the General Staff visualized the war on the basis of approximately 1,000,000 men. Our first call under the Selective Service Act was for 750,000 men to appear in September.

Our Army today is devoted to processes which are complete and effective. It would eliminate all elements of chance: so the thoroughness attained by the War Industries Board of March 1918 appeals to it. I do not in the least minimize the vast and valuable service to our nation which that body faithfully rendered. I do feel, however, that we must recognize that it was a development of a year's work and experience both in organization and personnel. It would be a serious mistake to anticipate that any body of men, however capable individually, suddenly summoned to man such an organization in an emergency, could even approximate the efficiency of the Board which Mr. Baruch headed in March 1918.

Our Army holds a doctrine to which I subscribe most sincerely. It is that a good soldier makes the most of such resources as are placed at his disposal. If everything is orderly, regular and sufficient, so much the better and thank God for it. But if that is not the case in another war and the Army has to improvise, and adjust, and readjust, and try to fit square pegs into round holes, and victory hovers on the brink, then for God's sake, let it proceed with what it has and not wait for the ideal. The latter condition faced the Administration and the General Munitions Board in 1917, and we tried to meet the emergency as good soldiers should with the only means then available. Restrictions were countless; authority and power were questionable; the requirements were only partially defined, and constantly changing. But we did not delay, we did not fall back behind excuses that might have been justified; we acted, and in this very way we saved months which may have saved the war.

The Allocation System

The Basis of Efficient Decentralized Procurement Planning

By Scott B. Ritchie*

THE Industrial Mobilization Plan of 1936 lays down certain principles of procurement planning for the purpose of insuring timely and orderly production, fabrication and supply of material required by the Army and Navy during a national emergency. Three of these principles are expressed in the plan in the following words:

"*e.* Industrial facilities shall be prorated for use by the Army and Navy in all cases where the ratio between productive capacity or availability and the combined Army and Navy demands indicate the necessity therefor or where such combined demands create critical problems relative to power, labor, transportation, or material. The necessity for and the extent of such distribution to the Army and Navy shall be determined by the authorized coördinating agency. . . .

"*f.* Up to the time that allocation of facilities or of materials is made to the Army or Navy as provided for in *e* above, each Department may proceed with procurement planning including the designation of facilities or sources of supply to meet its requirements as may be deemed desirable by such Department. If and when it becomes apparent that both Departments desire to utilize the same facilities or sources of supply, conflicting interests of the two Departments will be referred to the authorized coördinating agency.

"*g.* The two Departments may make direct use of unallocated facilities or of commercial supplies not designated for allocation control until such time as a shortage develops, or it has been determined by either Department or by a coördinating agency for procurement that a shortage will develop, at which time allocation between the Army and Navy will be made" (p. 1).

It is with the proportional division of industrial resources between the Army and Navy and with the assignment of definite facilities to an authorized procurement agency to meet its needs that allocation is concerned. A system whereby this is accomplished effectively is absolutely indispensable to the timely and orderly procurement of adequate munitions in war.

THIS article, the fourth of a series appearing in ARMY ORDNANCE on Industrial Mobilization Planning, is a discussion of the Allocation System. The subject, as we shall see later, is complex—complex in that it has so many ramifications; yet in principle, allocation is simple. The term as generally understood means the assignment of a facility in whole or in part to a procurement agency for its use in peace-time planning and war-time procurement. A facility is a factory, plant, or source of material with its pertaining organization and equipment.

The Army and Navy Munitions Board (See ARMY ORDNANCE, March-April, 1937, Vol. XVII, No. 101) now stands at the head of the allocation system and adjudicates allocations in which both Army and Navy have, or might have, an interest. Its position in this respect has been greatly strengthened in the 1936 revision of the Industrial Mobilization Plan.

To find the reason for an allocation system, it is necessary only to glance at World War experience. That experience was obtained more than eighteen years ago, yet it still has validity as a guide in the formulation of policy. A post-mortem in the light of that experience discloses many things that could have been done before the storm broke in 1917 which would have eased the stress on the economic structure. It also shows how things should not be done in a future emergency. This is especially true in respect to the distribution of the industrial war load.

Before the World War, the military procuring agencies placed their contracts for munitions on a competitive basis, much in the same manner as at present. For any given commodity required, the awards usually went to the same small group of well-known suppliers. Quite naturally these were the suppliers called in after April 6, 1917.

On the basis of this prior peace-time experience, the majority of these well-known commercial sources were preferred by all of the procuring agencies. Naturally there resulted vicious competition and great confusion in the scramble for preferential treatment at the hands of the preferred sources. Manufacturers, under a cross fire of conflicting demands, attempted to please too many procuring agencies at home and abroad and became hopelessly overloaded. Promises were given which were impossible of fulfillment. Some of the prime contractors sublet the major portion of their contracts. In reality they became a secondary line of governmental procuring agencies, extending the confusion. One result was that the great manufacturing area east of the Allegheny Mountains and north of the Potomac River was soon loaded haphazardly far beyond its capacity to produce.

IT was in the turmoil of this confusion that the germ of allocation originated. Early in 1917, the General Munitions Board, in an effort to relieve the situation, established the Clearance Committee. (See final report of the chairman of the War Industries Board to the President of the United States, Feb. 1919, pp. 12-13. U. S. Government Printing Office, Washington. 1935.) Items in which there were known shortages were cleared prior to purchase. Later the requirement of clearance was broadened to include all orders which involved production in congested areas and all orders necessitating new construction.

This method, however, was only an expedient pending the creation of a more effective mechanism. Other agencies came into being. By July 1918, the Commodity Sections of the War Industries Board took over the clearance function. The Clearance Committee was finally displaced by a Clearance Office which simply analyzed the projected orders and referred them to the appropriate Commodity Section of the Board for clearance, the nature of which depended upon the immediate situation in the commodity in question. Altogether

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This discussion presents the personal views of the author and does not represent official policy on the subject.

there were some 29,000 clearances—80 per cent of which were for the War Department, 15 per cent for the Navy, and 5 per cent for all other agencies.

This method of clearance was applied to orders as such, not to facilities. For the typical order, neither the procuring agency nor the supervisory agency knew what productive capacity was available. Time did not permit the collection of detailed information from industry. One of the great handicaps referred to in the final report of the War Industries Board was the lack of complete and flexible statistics of the manufacturing resources of the nation. To meet that deficiency, a facilities division of the Board was created to obtain a working inventory of available facilities. The results of its efforts, however, were not entirely satisfactory and pointed clearly to the fact that such data must be collected and carefully analyzed in peace time in order that they may be made effective upon industrial mobilization.

In default of detailed information on facilities, clearances were necessarily broad. At best, they merely reduced in some measure the areas of conflict. It is to be remembered, also, that clearance by orders forced the coördinating agency into details which could have been handled more properly by operating personnel.

Naturally those in authority just after the World War felt that the system which had been used was not altogether efficient. Consequently, one of the first problems to which the War Department addressed itself was the formulation of a scheme for assuring adequate provision for future emergency needs through some system of centralized supervision divorced from detailed operations. It was felt also, with due regard for strategic considerations, that the procuring agencies should spread the load evenly over industry. This not only would tend to obviate undesirable competition but would reduce the wastages due to idle capacity and would mitigate some of the effects of the usual postwar slumps. Associated with the desire to spread the load was the general aim of safeguarding the essential needs of the civilian population and industry at large, and of providing resiliency for the shock of any unforeseen contingencies.

IT was in the light of these facts, emphasized in the hard school of war, that Section 5a of the National Defense Act came into being. Under that mandate, the attack on the "what, where, and how" was inaugurated. It is the "where" with which allocation primarily is concerned, for allocation answers that question. This question of where to get the items in the time and quantities required involves two main considerations: 1. It is necessary to determine the capacity of industry or of specific facilities available and suitable to perform the required production. 2. This capacity must be apportioned equitably among the procuring agencies, including the Navy. If there is not enough existing capacity—plants in being—suitable for the purpose to meet all essential needs, then plans must be made for expansion or for new construction.

On the one hand are the needs of the various services—the job, if you please; on the other hand, the industrial resources or facilities—the means to do the job. Through the allocation system requirements are tied to resources in an attempt to secure a balance for those items which present serious problems in procurement. But allocation goes further. More specifically: 1. It permits exact and desirable prearrangement for production of munitions. Each allocated plant is forewarned of the task it will be expected to perform, and can make preparations to meet it, thus facilitating early production. 2. It permits orderly distribution of the war load, especially initial production. Any other system might throw this load haphazardly upon the country in an intensive and confused purchasing campaign when time is vital. 3. Undesirable competition, especially among procuring agencies for the output of a single plant, is reduced to a minimum. 4. Allocation should also ease postwar readjustment, since an effort is made to maintain a nucleus of civilian trade in each facility. Essential civilian needs are safeguarded.

In other words it permits us to make decisions and adjustments now which otherwise would have to be made on or shortly after M-day. That is of tremendous importance. However, do not believe from what has just been said that the system is perfect. It has defects and disadvantages. But the writer submits that it has more advantages and fewer defects than any other system that could be used to accomplish the same ends.

Pursuant to the mandate in Section 5a, it was decided, early in 1922, that facilities should be allocated. How and by whom this was to be done was a question that caused considerable discussion. There was doubt at first whether allocations, especially to the Navy, could be made, except by a superagency. Navy requirements obviously had to be considered. The Army and Navy Munitions Board was established in June 1922, but was not in shape to act on allocations until about three years later. There was no other higher coördinating agency in sight to which this activity might be charged.

It finally was decided in 1922 that the Office of the Assistant Secretary of War would allocate facilities to meet War Department requirements. In any event, judging by World War experience, the War Department could expect to account for the major portion of the total industrial war load. It was felt, however, that the War Department should confine itself to half the productive capacity in any given facility; the remaining capacity would be held as a factor of safety, for the Navy, and for civilian needs. Several years later, when the Navy began to participate, this policy was modified to provide for limiting the *combined* war load on a given facility to half of its productive capacity. Obviously this limitation has the effect of forcing a wide distribution of load.

On November 1, 1922, the Assistant Secretary directed the supply arms and services to requisition facilities. A blank form was provided for this purpose which, for each facility desired, called for a statement of productive capacity and of load to be placed. It was realized that both of these statements would be rough approximations only. Not until 1924 was there a military mobilization plan upon which requirements could be based; and since it is difficult to approach industry without definite requirements, little progress was made until that time, except to encourage adoption of a military plan. More to the point, the really important thing was that the allocation system had been launched.

THE first requisitions were received in December 1922, and the initial allocations were made in January 1923, just about fourteen years ago. In that same year, 1923, an important policy, still in effect, was announced as follows: "The allocation of a facility to one supply branch does not mean that another branch is prohibited from getting supplies

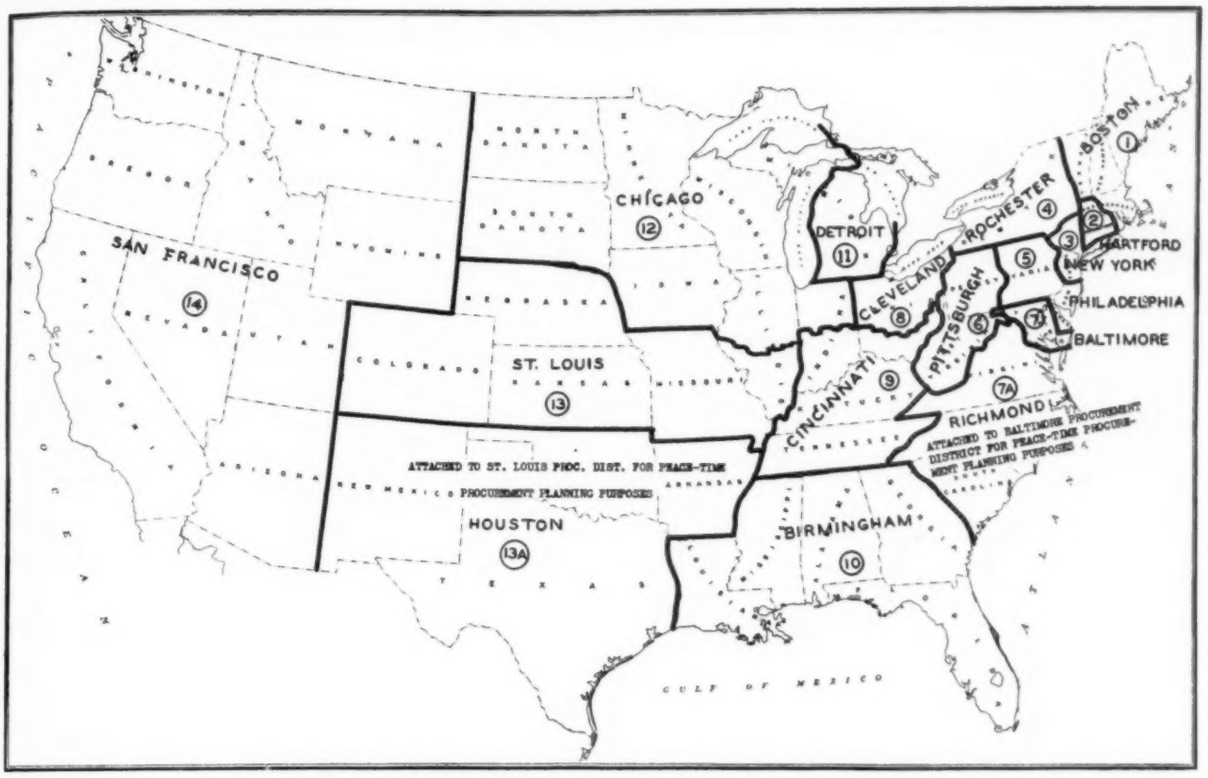

FIG. 1. ORDNANCE DEPARTMENT PROCUREMENT DISTRICTS

from that facility, but that the branch to which allocated shall have priority on its output, and that all demands of other branches on this facility must be presented to it through, or by satisfactory arrangements with, the branch or branches to which it is allocated."

The basic purpose of the policy just quoted was to open the way for full utilization of the allowable capacity of the whole facility. However, it always has been preferable, insofar as practicable, to allocate a facility exclusively to a single procuring agency. In this way the possibility of conflicts should be obviated and the burden of contacts on the facility reduced. But from the beginning it was found necessary to approve allocations jointly to two or more procuring agencies. At present the policy is to discourage joint allocations and to substitute therefor allocation by capacity credit, which will be discussed later.

When a facility is jointly allocated, the service having the basic allocation surrenders its exclusive interest. If the requirements of other services on the facility are relatively small, it is preferable to avoid joint allocation by placing their requirements through the procuring agency holding the original claim.

In 1931, it was announced that allocation of a facility included the plants and division operated directly under the main office, but did not include corporate subsidiaries. This policy is still in effect. In fact, it recently has been extended to encourage plant allocations. Separate allocation of plants is particularly to be preferred in the case of important plants widely separated or situated in different procurement districts and in which the main office of the controlling facility permits direct planning contacts with the plant. Allocation by plant not only facilitates detailed planning for production, but also affords a much better supervision of load distribution.

ALLOCATIONS are restricted to those items or commodities which present serious problems in procurement. Where potential capacity is greater than four times the combined requirements of the Army and Navy, and where the requirements do not involve substantial amounts of strategic or critical materials, allocations are not ordinarily made. These rules of course are not ironclad and must be applied with reason.

It is neither necessary nor desirable to allocate specific facilities to produce all the requirements. Most of the material that is of a commercial nature can be procured in time in the usual manner under competitive bidding. It is desirable of course to obtain competition wherever it is practicable to do so. It is mainly for the technical items with no commercial counterpart, or where there is a shortage in capacity and serious procurement problems will be encountered, that allocation is made; for example, to cover items like artillery, military aircraft, ammunition, bombs, fire-control instruments, tentage, gas masks, field communication equipment, special motor vehicles, and portable bridges. In most cases, such items as have been mentioned will have to be procured by components made in different plants sometimes widely separated; for example, one plant may make fuzes for the 75-mm. ammunition; another, cartridge cases; still another, the shell; and finally an entirely different plant may have to load and assemble the complete round.

It also is necessary to allocate sources of certain contributory materials to insure production of munitions; examples are machine tools and gages, without which mass production of critical munitions would be impossible. Other examples of important contributory items are woolen cloth, duck and webbing, rubber goods, aluminum products and steel products. For basic raw materials, however, like coal, iron ore,

copper, and cotton, allocation is not generally made. Such materials are continually studied and plans formulated by the Commodities Division, Planning Branch, Office of the Assistant Secretary of War, in coöperation with the Navy, to insure adequate supply in an emergency. (The subject of commodities will be discussed in a later issue of Army Ordnance.—Ed.)

The priority of the item determines whether allocation is necessary. No distinction is made between primary and contributory items, nor whether the supply arm or service or the prime contractor will place the contract. In other words, it is impossible to draw a straight line, to set up any hard-and-fast rule to separate those items which should be controlled by allocations from those for which allocations are not desirable. Especially is this true in respect to components entering into the finished item. Each case must be weighed on its own merits, due consideration being given to the importance of time coördination of the productive program.

To illustrate: A service has a facility allocated for production of special motor vehicles in the Detroit area. This facility in peace time obtains its chassis frames from another independent concern near by, and it desires to do so in war time. Therefore, other things being equal, it would appear desirable to allocate the independent concern to the service to safeguard this contributory source to the prime contractor. Yet it would seem unnecessary to allocate the sales agency from which the prime contractor procures his paints, or the public utility from which he gets his electricity.

Considerable discussion was had in deciding whether certain commodities like machine tools, basic steel products, aluminum products, and optical glass should be controlled through commodity committees or by allocation. A policy announced last year helps to clarify the matter on borderline commodities. It states, in effect, that for basic raw materials, allocations are not generally made. Allocations are granted, however, for essential contributory requirements in commodities which present serious problems in procurement and which are produced by manufacturing facilities subject to diversion to less-essential needs.

Such allocations are contingent upon the practicability of making a reasonable division and assignment of the available capacity to the procuring agencies. This normally is decided upon the recommendation of commodity or allocation committees on which all interested procuring agencies have representation. When the plans have progressed to the point where a satisfactory division of capacity can be made, the problem then falls within the purview of the allocation system for administrative control. In such cases, commodity committees normally are continued in a fact-finding and advisory capacity. Typical examples of commodities handled in this way are machine tools and basic steel.

It is to be noted that where there is a shortage in capacity to meet requirements and conflict develops among the procuring agencies, military priority will govern in the adjustment. Quantities needed at specific times are considered to insure effective time coördination of the productive program. Borderline commodities not subject to allocation control include groups like building materials, such as lumber, cement, and plumbing supplies; petroleum products, including gasoline, kerosene, lubricating and fuel oil; paint and paint products and office supplies and equipment.

Allocations in the great majority of cases are confined to potential manufacturing facilities. Sales agencies, jobbers, and importers ordinarily are not allocated, neither are governmental facilities and facilities outside the continental limits of the United States.

Perhaps the greatest disadvantage of the allocation system applies to administrative control after M-day, especially if the system is carried too far. Some people would allocate for everything—others for only the most critical items. Between these two extremes is a twilight zone through which reason and good judgment must point the way. Excessive allocations will bog down in red tape and might cause the whole system to collapse. As allocations are increased, the opportunity for free competition decreases. Negotiated prices that are too high will bring public condemnation; those which are too low will discourage effective production. Allocations, in order to stand, must be sound and justifiable before Congress and the people. For these reasons, the number in peace time should be held to a justifiable minimum.

Thus far this discussion has been confined to allocations made outright, as in the case of a facility assigned wholly to a single service, or jointly to two or more services. More important perhaps is an abstract concept of allocation known as "capacity credit," especially applicable to certain large facilities in which all services inevitably must have requirements.

In the case of large complex organizations, production was so interdependent on common "bottle necks" and other common factors that the resolution of conflicts through straight allocation would be impracticable. The answer was the assignment of prospective tasks rather than the reservation of machines and plants; the allocation of productive capacities rather than physical facilities. In this lay the solution, not only of the residual conflicts within the War Department, but also of a far wider range of potential conflicts with the Navy Department. This idealized concept of allocation paved the way for a fuller utilization of the available productive capacity and for more effective coördination of the separate demands by a system of central control. Allocation by capacity credit is especially applicable in situations of indefinite or rapidly changing requirements where maximum flexibility with centralized control is desirable.

The first step was to group for special treatment all those important facilities to which straight allocations could not well be applied. These included basic steel facilities, the machine-tool and gage facilities and others jointly allocated in which three or more services were interested. These facilities were listed separately, under the designations "Reserved (OASW) Facilities," or "Reserved (ANMB) Facilities"; *i.e.*, reserved by the Office of the Assistant Secretary of War or by the Army and Navy Munitions Board, respectively. The term "reserved," however, did not mean that such facilities were not available to the procuring agencies.

Initially, facilities in which both Army and Navy participated were allocated jointly to the two services. At the present time, facilities in which both services have an interest are carried in the special group called "Reserved (ANMB) Facilities." This means that no load, Army or Navy, may be placed on these facilities without prior approval of the Army and Navy Munitions Board.

Once the productive capacity of a reserved facility had been estimated, portions of the available capacity, com-

mensurate with their needs, were assigned to the services upon request. To these portions of productive capacity was applied the term "capacity credits."

Whether allocation should be jointly or by capacity credit has been a much-discussed point. Both undoubtedly fill a useful purpose. In October 1934, the Director of the Planning Branch announced that it was preferable to allocate on a capacity basis in terms of capacity credits rather than by facilities. It is now felt that, in general, where two or more procuring agencies have or may have important interests, allocation should be by capacity credits.

The desirability of apportioning the capacity to the procuring agencies has been mentioned. But before this can be done it is necessary to find out how much there is and where it is located. To make intelligent allocations, not only must requirements be known, but information as to what individual facilities can do also is essential. Plants must be studied and the management must be consulted. Obviously, not all firms are suitable for making munitions, nor is it desirable for some of them to attempt such production.

THE first method used in an effort to get this information was to flood industry with questionnaires relating to shop equipment and productive capacity. In many cases, especially in the larger concerns, it would have taken considerable time and energy to compile the data requested. The reaction from industry was not favorable, and some concerns complained to the Secretary of War. In May 1923, the use of questionnaires was forbidden. This ban is still in effect.

As an alternative, it was thought at one time that the Bureau of the Census could be used to assist in surveying industry. Late in 1925, the Bureau sent out special forms to some 15,000 facilities each having a value of product of $500,000 or more per annum. The facilities were asked to state: (1) Principal commodity produced during the war; (2) Amount produced; (3) Present status; (4) Type of work for which best suited; (5) Alterations necessary. The reports were received in 1927 and resulted in some 500 new allocations.

A second census canvass was made from 1927 to 1929, but proved of little value. A third, inaugurated in 1929 and completed in 1931, obtained certain information regarding skilled labor for the Navy and the Ordnance Department, but was of no great importance. Some assistance as to capacity and distribution of industry also is obtained from time to time in publications of other Federal departments and of State governments.

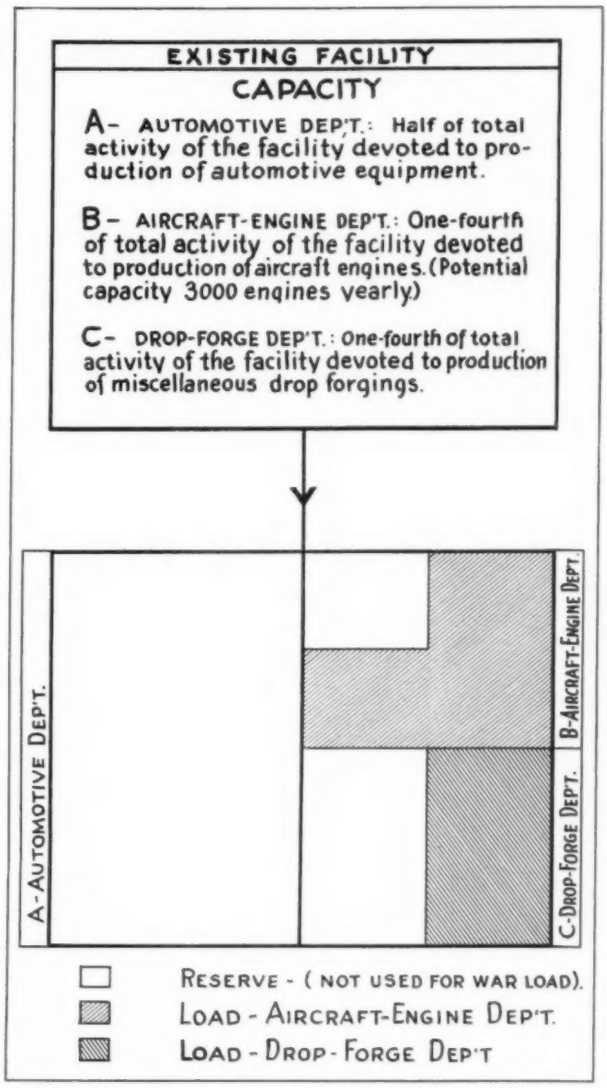
EXISTING FACILITY
CAPACITY
A- AUTOMOTIVE DEP'T.: Half of total activity of the facility devoted to production of automotive equipment.
B- AIRCRAFT-ENGINE DEP'T.: One-fourth of total activity of the facility devoted to production of aircraft engines. (Potential capacity 3000 engines yearly)
C- DROP-FORGE DEP'T.: One-fourth of total activity of the facility devoted to production of miscellaneous drop forgings.
A-AUTOMOTIVE DEP'T.
B-AIRCRAFT-ENGINE DEPT.
C-DROP-FORGE DEP'T.
RESERVE - (NOT USED FOR WAR LOAD).
LOAD - AIRCRAFT-ENGINE DEP'T.
LOAD - DROP-FORGE DEP'T

FIG. 2. METHOD OF COMPUTING AND REPORTING WAR LOAD

The Automotive Department is reserve. The load placed on the Aircraft-engine Department is 2250 engines yearly. Hence the *item load* is 250 x .75, or 188 points. The *plant load* is 188 x .25, or 47 points. The remainder of this department is reserve. Half of the Drop-forge Department will be converted to the production of armor-plate castings by the installation of high-frequency induction furnaces. The *item load* displaced is 250 x .50, or 125 points. The *plant load* is 125 x .25, or 31 points. The remainder of this department is reserve. The *total plant load* then is 47 + 31, or 80 points (to the nearest multiple of 5).

Experience, however, has shown that for a detailed study of individual facilities requisite for planning as well as for procurement in war time, a territorial decentralization of activities is essential. Each of the services responsible for actual procurement has divided the country into procurement districts, the number and boundaries of which have been set to meet its particular needs for planning in peace and for decentralized procurement in war.

In the average district there is a skeletonized staff consisting of the district chief, usually a prominent business man residing in the locality, who may or may not be a Reserve officer; an executive assistant who is a Regular officer of the branch concerned; and the necessary clerical personnel. The district organization is maintained for two very important reasons: First, to make detailed survey and study of each plant to be used, and secondly, to form a nucleus for expansion in case of emergency. Fig. 1, for example, shows the districts used by the Ordnance Department. Maj. Gen. William H. Tschappat, Chief of Ordnance, in an article, "Ordnance Principles," published in the July-August issue of ARMY ORDNANCE (Vol. XVIII, No. 103, pp. 17-18) states that he believes the Ordnance Procurement Districts will be the salvation of the Ordnance Department in war. Undoubtedly other services regard their districts as equally significant in their procurement set-up.

The Regular Army personnel at the several district headquarters are literally on the "firing line," for it is through

them that the great majority of contacts are made with industry. By the procedure known as "survey" they acquire detailed information relative to a facility's equipment, its capacity, and prospective suitability to produce items required by a procuring agency. Obviously, much of the information obtained through survey of industry is of a confidential or secret nature, both from the standpoint of the source from which it comes and of the agency to which it is divulged. It is handled and safeguarded in accordance with Army regulations governing such matters.

Up to about two years ago, in order not to antagonize industry, surveys could not be made until facilities had been allocated. The normal cycle was: requisition, allocation, survey, and then cancellation or placement of schedules. This resulted in much wasted effort. The present policy, with more experienced personnel in the field, is to permit preliminary survey to determine suitability before allocation.

IT is to be noted that the survey of industry on the part of the War Department is performed by the supply arms and services in accordance with policies formulated by the higher echelons in the allocation system on the Army side (Planning Branch, Office of the Assistant Secretary of War, and the Army and Navy Munitions Board). In allocation, the higher echelons are concerned primarily with matters of policy, division of capacity, assignment of facilities, and general supervision over the distribution of load.

Let it be remembered in passing, that survey of industry touches one of the vital elements in procurement planning. It will be recalled that one of the great weaknesses at the beginning of the last war was the lack of comprehensive statistics on manufacturing facilities. It is desirable to have a complete and up-to-date survey at all times, not only to facilitate intelligent and equitable allocations but also to furnish data for the utilization of competitive bidding when in the interest of the Government. Obviously, the survey work is a continuing function. This is necessary because neither requirements nor resources can remain fixed. Policy calls for a survey of all allocated facilities at least once every three years. It must not be forgotten, however, that surveys entail a great amount of work and are restricted by fiscal limitations. Inquiries last year disclosed that in the districts more time was devoted to surveys and locating prospective facilities than to any other activity.

The supply arms and services, having computed their needs under the mobilization plans set up by the General Staff, apportion these requirements to their several districts. In doing this they attempt to spread the load as evenly over the country as practicable. Based upon the data which they have available or upon additional surveys if necessary, the districts search out the facilities best suited to do the job and submit requests through their branch chiefs to the Office of the Assistant Secretary of War for definite assignment of the plants. These requests usually come in on special forms to which reference again will be made. When the requests for allocations are received in the Allocation Division, Planning Branch, Office of the Assistant Secretary, they are analyzed to see if there will be any conflict with other services or with the Navy, and if necessary, adjustments are made.

If there is shortage of capacity, as in the case of certain critical items, it sometimes becomes desirable to have special studies made by allocation committees on which each interested service is represented. Notable examples where this has been done are in the cases of aëronautical matériel, machine tools, and powder and explosives. In such cases, of course, it is very important that the capacity be divided equitably in line with military priority. Attempt is made to utilize to the fullest the existing plants, but in some cases it is necessary to plan for expansion or for new construction. Special studies have been made by the Construction Division of the Planning Branch and the areas where there is liable to be congestion in the building industry have been spotted. Any new construction of plants is kept out of these areas as far as is possible to do so.

After the plants are selected and the allocations approved, the requirements on each facility are finally submitted to the management by the districts on what is termed a "schedule of production." The management's signature to this schedule indicates the willingness and ability of the firm to produce the items at the rates prescribed. The "Accepted Schedule of Production" is the link which actually ties in the requirements with the resources.

Let us examine the accepted schedules a little further. They perform a very important function. True, they are not contracts, nor do they bind the Government or the facility in any way. But they do afford an incentive and fix definite objectives for the facility to plan in detail; and through the close contacts thus afforded, the elements of cost may the more readily be studied in the development of wartime contracts to protect both industry and the Government. Determination of prices by negotiation at the outset of the emergency will be facilitated. More important, perhaps, is the fact that through these schedules industry becomes conscious of our requirements and our problems.

A large number of prospective facilities have been surveyed. The work has been in progress almost continuously since the World War. From among this number slightly over 10,000 firms have been selected and are now on the allocated list. Thousands of these, without any obligation on the part of the Government, have taken the preliminary steps incident to production. Many have prepared detailed factory plans. They have cataloged the additional machine tools required, they have studied their sources of raw materials, and they have made plans for conversion and expansion from their normal products to the noncommercial military items. In many instances Reserve officers have rendered invaluable assistance in these studies and in the preparation of factory plans pertaining to their own organizations. Without allocation these essential activities could not well be accomplished. This preliminary work will save months of vital time in starting production. In all this work the War Department has received whole-hearted coöperation from industry.

LET us now turn to a consideration of load, one of the most difficult yet vital elements in the allocation system. The purpose of recording the industrial capacity utilized by the several procuring agencies is to afford: (1) a broad picture of the war load to be placed on industry, so that suitable distribution may be assured; conversely, an indication of the industrial capacity remaining after the load has been placed, and its location; (2) a check on the load placed on individual facilities or industries to insure that they are not unnecessarily overloaded, that a proper reserve is maintained, and that civilian needs are considered; (3) an indication of the amount of conversion, expansion and new construction that will be required to carry the load; (4) data

for analysis of the problems of labor, power, construction, and transportation.

Load is the proportion of the potential capacity of a facility which will be used to meet war-time requirements. Potential capacity, *which is the maximum output of an existing facility,* is taken as the base against which load is computed. This base is given an index value of 250 points regardless of the number of shifts or hours that the facility can be operated. It is assumed that in war the great majority of facilities can run on a 24-hour basis—usually three 8-hour shifts. Since three 8-hour shifts are taken to be equivalent to 2½ times one shift, the 250-point index is based essentially on the scale: 1 shift equals 100 points; 2 shifts, 200 points; and 3 shifts, 250 points.

The load is now reported to the Allocation Division, Planning Branch, by the procuring agencies separately for each item under two categories—item and plant.

Item Load is the number of points of capacity out of 250 potential in any given item which is to be absorbed in meeting a given schedule. For example, suppose we have a facility producing only two items, cable and switchboards, and that the war load takes the maximum output from the cable department. The item load for this commodity then would be 250 points potential.

Plant Load is the proportion of the 250 points potential of the *whole* plant which is to be absorbed in meeting a given schedule. In the foregoing illustration, if the production of cable absorbs one-half the activities of the whole facility, and all the cable be taken, then the *plant* load for cable would be half of 250 or 125 points. (Fig. 2 illustrates the method of computing and reporting load.)

Item loads (Army and Navy) are grouped into general categories to correspond with subdivisions of productive industry. To each commodity group is assigned a commodity symbol consisting of a combination of letters on the plan outlined in the Federal Standard Stock Catalog. Item loads are consolidated and recorded by commodity-symbol groups. Each group in turn is broken down geographically by procurement zones, by states, by cities, and finally by facilities. Inequitable loadings as between and within different procurement districts automatically are signaled for correction.

All loads are required to be verified at least once every three years. Allocations in force for more than five years and against which no load has been reported are considered as potentially available for cancellation and reassignment. By proper supervision in the higher echelons, a reasonably even distribution of load over industry is assured. Individual plants are not loaded beyond allowable capacity. As a result, the load is now fairly well distributed. There will be no vicious competition among the procuring agencies for the output of a single plant as was so prevalent in the last war. Overloading of plants and areas, such as occurred in the Northeast in 1917-1918, will be reduced to a minimum.

During the past few years the allocation system has developed into a potent force in the scheme of industrial preparedness. Policies have been established and principles enunciated to guide future activities. In all procurement planning it is axiomatic that the efforts of the Army and Navy should be coördinated. The Industrial Mobilization Plan of 1936 is the instrument through which coördination in industrial mobilization is obtained. The Army and Navy, through the Army and Navy Munitions Board, are now working side by side to match requirements in the solution of allocation problems which are common to both services.

Before leaving the subject of allocations, it seems appropriate to examine the records. As indicated before, the Allocation Division of the Planning Branch is the office of record for all matters pertaining to allocations. It maintains a master file and periodically publishes several directories.

The master file upon which all allocation records are based consists of special forms which originate in the field and carry an abstract of pertinent survey data. The forms are arranged alphabetically in a visible card file. The data on file for each allocated facility include such information as name and address, list of plants operated with their location, number and kind of employees, financial rating, normal products, capacity for production, items to be produced in an emergency, date of accepted schedule, and the capacity utilized by the load. In support of these data is a mass of detailed survey information maintained by the services and the districts.

THE information recorded in the master file is broken down, first, alphabetically by name of facility and plant; secondly, geographically by industrial regions, States, and cities; and thirdly, by commodities or related industries, each of which in turn is broken down geographically. These records are maintained on some 50,000 unit cards posted day by day. The information recorded on these cards is published to the procuring agencies by lithographic reproduction. By this means both the Army and Navy, including their respective field agencies, are kept advised of the status of all allocations and the distribution of load. The load is recorded under some sixty main commodity groups and about fourteen hundred subdivisions. These records are all kept in such shape as to be readily available for use by the Army and Navy Munitions Board or a superagency.

Detailed plans have been made for expansion of the allocation system to handle the increased activities in time of war. The organizational set-up is simple and flexible, built for smooth transition to an emergency basis.

Inauguration of the system probably will require some adjustment in peace-time allocations. By virtue of the complexity of the problem, some decisions must of necessity be left for M-day. The extent to which allocations are to be applied will depend upon the nature of the emergency and other circumstances which cannot now be determined. If it is a maximum effort, the problem is comparatively simple. If a lesser effort, a greater degree of competitive bidding may be used. In either case some desirable competition will obtain even among allocated facilities within each service.

In conclusion, the allocation system permits prearrangement for the production of munitions, safeguards essential civilian needs, reduces undesirable competition to a minimum, and equitably distributes the war load. To the procuring agencies are left the operational details; to the central agency is given an effective means through which war-time control measures may be applied. Allocation enters both phases of the responsibility under Section 5a of the National Defense Act. It is an essential step in procurement planning. It also enters industrial mobilization in that the system is built to continue to operate in war.

Through the allocation system effective decentralized procurement planning is realized. In fact, allocation is vital in the framework upon which is built all detailed plans.

Light Machine Guns

They Should Reconcile the Demands of Mobility and Fire Power

By Melvin M. Johnson, Jr.*

RECENTLY I had the pleasure of conferring with a well-known colonel of the Infantry. We were discussing machine guns and semiautomatic rifles. He warned me of the disadvantages which arise from too much complication in our weapons, and by way of illustration, told me about a certain French machine-gun school held for our officers during 1918. It seems a French instructor addressed the school as follows: "Monsieurs, it is wiz ze most great pleasure I inform you that we have exceedingly simplify and improve ze light machine gun by ze mere addition of a numbair of parts!"

But when we consider the phenomenal speed with which the French ordnance experts constructed the Chauchat, as well as their remarkable ingenuity in perfecting and producing the 75, we scarcely can question their justification for adding "a number of parts" in the 1917-1918 period.

Twenty years have passed. Great strides have been made in heavy ordnance, in aviation, in mechanization, in motorization, in signal communication, and in the exterior ballistics of small-arms ammunition; there is not space to itemize all the achievements here. Moreover, we are concerned primarily with light machine guns. In discussing certain pertinent questions relative to such weapons, it will be assumed that the reader knows the outstanding mechanisms in a general way.

To begin with, historically, Hiram S. Maxim invented a recoil-operated machine gun in 1884, Browning a gas-actuated gun in 1889, and Odkolek the gas gun, later known as the Hotchkiss, in 1890. Maxim's gun was taken over by Vickers, and the rather heavy mechanism was used in several calibers. The gas-actuated Benét-Mercié, modified from the Hotchkiss, was in use before the World War and is familiar to many readers.

Just before the World War, a gas-actuated rifle, the Mondragon, was brought out by a Mexican; the Germans used and discarded this weapon in 1914. The French had the St.-Étienne, also gas-actuated and unsatisfactory. Then came the gas-actuated Lewis, a lighter machine gun than many, the recoil-operated heavy Browning caliber .30, model of 1917, water-cooled, and the gas-actuated light Browning or Browning machine rifle, caliber .30, model of 1917, also known as the B.A.R. The famous French recoil-operated Chauchat machine rifle made its appearance in 1915. Since the war, the heavy Browning recoil mechanism has been modified into several models. However, there is no radical departure in any of these weapons from their common "ancestor," except that most of them are air-cooled, and have a higher cyclic rate of fire. Some of these models are loosely labeled "light" machine guns.

The Browning machine rifle went the way of all guns, adorned with a bipod and festooned with a 100-round belt. I am informed that the cavalry perpetrated this outrage on the B.A.R., which also has been violated by a modification alleged to diminish the "number of parts," yclept the "monitor." Both of these "improved" weapons are responsible for divers "alarums and excursions" on the part of those with whom rumor tarried fruitfully, the theory being that the first was a brand-new light machine gun, the second an equally brand-new semiautomatic rifle, even better than the Garand, a comparison which left some of us utterly cold.

A number of light machine guns have cropped up abroad, yet, even as many of the above-named, I suspect they are like old bottles with new wine in them. Among others is the gas-actuated Bren light machine gun, recently adopted by the British and rejected by the United States. Reports indicate that the Madsen, a recoil-operated weapon, showed up better in recent British tests than the Bren. The Italians have a weapon called the "Breda 29." The Germans also have a light machine gun. The new Garand semiautomatic rifle, caliber .30 Mark I, perhaps may be deemed suitable for modification into a light machine gun. In fact, this mechanism might be even better adapted to a machine gun than to a rifle. However, if a high rate of fire is desired, it is doubtful whether a gas actuation of this type would be suitable.

MANY years ago, when the lumberjacks, ripe from the woods, used to come "down river" to Bangor, Maine, a raucous river-driver collided on Main Street with an extremely cross-eyed member of the gentler (but in this case not fairer) sex. Said the lady: "For goodness sake, why don't you look where you're goin'?" The river-driver took one look at the lady's crossed eyes, and replied: "Why don't you go where you're lookin'?"

Now the service has been looking for a light machine gun for some years, as well as for a semiautomatic shoulder rifle. The service has been looking for *simpler* and *lighter* infantry weapons. The Chief of Infantry has repeatedly stated that it is desired to reconcile fire power and mobility. But when we begin to consider the more immediate, yet no less pertinent matters involved, some want to go one way, and some another. We are faced with the dilemma of the cross-eyed lady. We cannot go where we are looking, because we are looking in several directions at once. Our immediate objective, then, is to determine *which way* we are looking. Our ultimate objective is to *go* where we are looking. However, before we start, we must keep one point in mind: We must not look where it is physically impossible to go, as the cross-eyed lady did when she bumped into the lumberjack.

We want a light machine gun. We also want a heavy machine gun. Furthermore, we want a semiautomatic rifle. But what have the heavy gun and rifle to do with a light machine gun? Plenty. We want the basic mechanism to be the same in all three. Why? Because we must simplify our infantry training. We cannot put recruits through a technological school to fit them to operate their infantry weapons. At the present moment we teach the Springfield,

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the Colt pistol, B.A.R., heavy Browning, and Thompson submachine gun, each one of which is materially different from the other. Are we going to add to these a gas-actuated rifle in place of the Springfield, and some form of light machine gun in lieu of the B.A.R.? If that is where we are looking, do we really want to go there?

Probably the hardest task of all is for one individual to see everyone's point of view, besides his own. Nevertheless, I shall presume to do so in discussing the ideal light machine gun. There are four viewpoints involved: that of the soldier, that of the manufacturer, that of the inventor, and that of the pocketbook. Naturally, my own experience leads me to bear very strongly on one of these viewpoints, and for that I ask leniency.

Machine rifles, light machine guns, and automatic rifles are almost one and the same. If the weapon has a stock and can be fired from the shoulder, however inaccurately, or if it has a "switch" for full or semiautomatic fire, it is called a machine rifle or automatic rifle. If it has a tripod or bipod, it may be called a light machine gun. Most of these weapons have been poor excuses for a semiautomatic shoulder rifle, a much-sought but not truly achieved weapon.

Let us assume we actually have serviceable semiautomatic rifles, and separate heavy machine-gun battalions. We want some full-automatic fire in every squad or group of the rifle battalions. Mobility is absolutely essential, so the machine gun must not weigh more than eighteen to twenty pounds. In order to fire bursts accurately, the gun must have a mount—either a bipod and special butt plate, or a modified tripod. The mount will have to weigh several pounds, so we must make our operating mechanism quite light. Moreover, we shall find it necessary to dispense with water cooling, because such devices add too much weight.

Air cooling appears to be mandatory. In fact, due to the difficulty of replenishing water in combat, it is desirable to have air cooling in a truly mobile machine gun. But machine guns heat up terrifically. How can we get adequate air cooling? The best way is to use a heavy barrel, which incidentally, is more accurate. Experience has shown that the heavy barrel will withstand a considerable amount of heat, well beyond the proportion of its increased weight. Moreover, the heavy barrel should be exposed to the air as much as possible on all sides, so that it can radiate its heat, or, if you are physics-minded, so that the surrounding air can take heat away from the barrel. The barrel of any weapon which fires with any degree of rapidity should be exposed to air as much as is reasonably possible. Bear that thought in mind when considering semiautomatic rifles as well as light machine guns.

THE "cyclic rate of fire" raises several difficult points. With respect to the problem of cooling it would seem that too high a rate of fire causes excessive heating. Of that there can be no doubt. Moreover, erosion of the bore is increased, and the life of the barrel is shortened materially. For these reasons we must provide for a rapid and extremely simple means of removing and replacing an overheated or worn barrel. This operation should not and need not take much longer than it takes to replace a magazine in the B.A.R. At this point I wish to assure the reader that none of the possibilities indicated, such as the above, is impossible; any or all can be proved, if necessary.

For the purpose of dismounting barrels easily, gas-actuated weapons are not particularly well suited. The slidably mounted barrel of a recoil-operated gun might be more readily dismounted. This point is raised because I believe the gunner should change barrels every 200 rounds, provided he is firing intensively. This change would lengthen the life of the barrels noticeably.

But why should the service require an increased cyclic rate of fire? Of course, the aviation problem is obvious. Planes fly so fast that the pilot is on his target for a bare second or even less. He must "pour in" all he can in a very short interval. Consequently, the aviator has asked for a cyclic rate of fire in excess of 2000 rounds per minute.

Such a rate, I submit, seems almost mechanically impossible with our present caliber .30 or caliber .50 ammunition, and in most respects is tactically unnecessary. For example, if a gun fires at the rate of 1200 rounds per minute, it is firing 20 rounds per second. The muzzle velocity is 2700 feet per second. Thus, when the first bullet is, roughly, 135 feet from the muzzle, the second bullet is just leaving the muzzle. If the gun fired at 2000 per minute, the bullets would be roughly 82 feet apart. Even if the breechblock could be unlocked just as the chamber pressure dropped to a safe point, the breechblock would have to travel back and forth at a very high speed, and the ignition would have to be instantaneous.

Personally, I do not believe too much in figures, especially after noting the inaccuracies of "computed data" in the elevation tables of those small-arms manuals used during the war. For example, as I recall it, the extreme range of the .30, model of 1906, ammunition was alleged to be 4891.6 yards at 45 degrees. But about the time I began my first juvenile excursions with the .30 rifles, the Daytona Beach tests disclosed, by actual firing, that the extreme range was actually only 3300 yards at 30 degrees. That six-tenths of a yard (computed) has amused me ever since. I place more faith in actual tests. Therefore, on the basis of actually firing a weapon which cannot unlock its bolt any sooner than it does (because if it did, the pressure would be dangerously high), I have concluded that 1500 rounds per minute is about the limit. The gun in question is estimated at 1200-1400 rounds per minute.

But even though airmen need a high rate of fire, is this true of ground troops? Well, ground troops will have to shoot at airplanes, fast-moving tanks, armored cars, and the like. I doubt that any troops will ever again march in close order under fire from automatic small arms. So targets will not appear so often, will be extremely wary, and quick to take cover. The machine gunner will want to "get there first with the most" bullets. Heavy machine guns, firing barrages, will require intense bursts. So will the light guns. On the whole we may conclude that our light gun should have a fairly high rate of fire.

Such characteristics are wholly in accord with the tactical concept of striking the enemy suddenly and with great force (mobility, surprise, mass). For missions requiring a low rate of fire, the semiautomatic rifle should be extremely efficient and economical.

THE third and most important problem raised in connection with the cyclic rate of fire (we have just considered cooling and the cyclic rate itself) is the *type of feed* to be used. This problem is of paramount importance. Naturally it has caused some discussion in ordnance circles. It is hoped

that some light may be cast on the dark spots by our discussion.

Hiram S. Maxim invented a belt feed for his original machine gun, and there have been innumerable varieties of belt feeds ever since. The drum and the strip have been less popular. The B.A.R. uses a 20-round detachable box magazine. So far as water-cooled, heavy guns are concerned, the belt is desirable beyond much question. The argument arises in connection with the use of a belt or a box magazine in the light machine gun.

Here is the place for the soldier to put into practice a principle of war—coöperation. We have the soldier, inventor, manufacturer, and pocketbook to consider. Perhaps the soldier really needs a 100-round belt. Perhaps he would be better off with a box magazine. But the inventor and the manufacturer would much prefer to use the magazine than the belt feed. The gun would be infinitely simpler to design and cheaper to produce. B.A.R. box magazines are very easy and inexpensive to manufacture. A simple spring in the magazine does the work that a lot of gears and gadgets must do for the belt to keep pushing cartridges into the loading position. It is hard enough for the inventor to develop a really simple operating mechanism. When he does contrive to do so, the imposition of a belt feed is insupportable. He feels like the famous chef who killed a man who drank his soup, because: "The boss he say to cooka da best soup. Four days I worka. I cooka da swellest soup ina da whole world. What he do? Firsta thing, right offa da bat, he puta da *salt* in my soup, so I killa heem as he reacha for da pepper."

So much for the inventor, manufacturer and pocketbook. The soldier is the most important. But even the soldier must consider certain material factors, aside from coöperating with the inventor. First of all, we must not forget the limitations on weight. Secondly, we must remember that we have an *air-cooled* gun. A belt and an air-cooled gun are not compatible. For one reason, among others, the belt does not insure any cooling intervals. Again, there is that little problem of ammunition supply. The gunner's assistant very readily can replace magazines every burst or two while the gunner is checking his sights or looking for new targets. The difference in fire efficiency is quite negligible. Those who still doubt might consider how many times a belt feed is likely to jam, and how much time may be taken to make repairs, as contrasted with the mere removal and replacement of a B.A.R. magazine.

The little anecodote about how the French simplified and improved the light machine gun "by ze mere addition of a numbair of parts," is quite relevant here. The less working parts the machine gun has, the less likely it is to malfunction and necessitate repairs. *Belts add parts.* This gun should be as simple as the semiautomatic shoulder rifle, for it is a platoon weapon and will not be operated in combat by experts from the machine-gun school. If a smaller caliber were used, such as a .23 or .25, the cooling problem might not be so acute, and the belt might be feasible in that respect. But we need uniformity and interchangeability of ammunition above all. We must stick to the .30 Mark I for rifles and machine guns.

Mounts have been a source of some argument in connection with light machine guns. The controversy is narrowed down to the tripod and the bipod. The light machine gun is going to follow the riflemen. Wherever the riflemen go, there also shall the machine gun go, and wherever the riflemen lie there also the machine gunner shall lie. Thus we raise the point that the gunner will necessarily assume the prone position in almost every situation. The bipod is far superior to the tripod for prone shooting. A bipod with special butt plate is easier to anchor than the type of light tripod which must be used with the light machine gun. The gunner can transmit some of his weight to the gun when it is mounted on a bipod and has a stock for his shoulder. A tripod is equipped with traversing gear. This smacks of artillery and has no place in an infantry-platoon weapon.

The light machine gun will do the work of the B.A.R. much more effectively and efficiently. But it is not safe to use a light gun to fire over the heads of friendly troops unless their position is absolutely masked from the supporting gun. Therefore it is safer to conceive of the light machine gun as an improved B.A.R. than as a more mobile heavy Browning. Our basic concept, if carefully chosen, often helps us to formulate our theories more clearly; but if we confuse our concept, the results are rarely of great value.

THE direction in which we are looking has already been given our careful attention. We are, in short, looking for an automatic mechanism of extreme simplicity which can be adapted to the semiautomatic rifle, the light machine gun, the heavy machine gun, and possibly to the caliber .50 antiaircraft gun. Such a mechanism would simplify training.

In particular, our light machine gun should be air-cooled, *magazine-fed,* mounted on a bipod, having a shoulder stock with special butt plate, weighing hardly more than a B.A.R., yet having an accurate, heavy barrel. This weapon should have a cyclic rate of fire of from 1200-1500 rounds per minute. The barrel should be capable of being dismounted and replaced in less than ten seconds. The gun should be extremely cheap and simple to manufacture, should have very few working parts, and should be easy to dismount and assemble with a minimum of instruction.

A few points are left for consideration. Should the light machine gun be capable of firing semiautomatic as well as full automatic? Should it be cocked with the breechblock open or locked? Due to the tremendous heat generated in the barrel of an automatic gun, it is not always safe to leave a loaded cartridge in the chamber on account of the possibility of accidental discharge. Therefore the gun should be cocked with the breechblock open. But a gun fired semiautomatically is not very accurate unless the breechblock is locked before the trigger is pulled. The B.A.R. and the Thompson are especially inaccurate because when fired semiautomatically the forward movement of the breechblock tends to disrupt the aim. Therefore, since we count on having semiautomatic rifles, there seems to be no particular advantage in burdening the mechanism with a complicated selective trigger mechanism.

A light machine gun on the above lines would seem to satisfy the otherwise irreconcilable requirements of mobility and fire power. Assuming, therefore, that we are looking in that direction and have nothing crossed except our fingers and our *T's,* why don't we go where we are looking? That is the question which the soldier asks the inventor and manufacturer. Their answer is, "Perhaps we are."

On the other hand the inventor and the manufacturer cannot go where the soldier is looking if he, like the cross-eyed lady, is looking in more than one direction at the same time!

Notes on Light Armor Plate

The Characteristics and Theory of Penetration Resistance

By J. C. Gray*

LIGHT armor plate such as is used on tanks and armored cars is essentially similar to the heavy armor used on battleships. The technical difficulties of manufacture are really increased by the fact that the plate is thin rather than thick. There are two classes of light armor plate: the type in which the face exposed to fire is hardened over and above the hardness of the entire plate, and the type which has the same hardness or consistency from face to back. These two types are known as "face hardened" and "homogeneous" armor plate, respectively.

In general, armor-piercing bullets of small arms are made with a gilding-metal jacket and a steel core which is specially heat treated so that the point of the core which strikes the armor plate will be sufficiently hard to penetrate, whereas the rear portion or body will be strong and tough enough to resist deformation. The dimensions must be held to very close tolerances or the bullets will not be satisfactory. This is accomplished by a centerless grinder which produces bullet cores that have variations in diameter probably not exceeding two ten-thousandths of an inch.

The most important factor for the penetration of armor plate is, of course, bullet energy. Since kinetic energy is expressed by the formula $\frac{MV^2}{2}$ in which M is the mass and V the velocity, the importance of velocity is out of all proportion to the importance of mass. Striking energy, expressed in terms of foot pounds, is usually obtained by a modification of the above formula as follows: $E = \frac{WV^2}{2 \times 7000\ G}$ in which W is weight of bullet in grains, G the acceleration due to gravity (32.2), and 7000 the number of grains in a pound. So important is the velocity factor, that if very high velocities are obtained over and above the critical velocity of about 3400 or 3500 f.s., ball ammunition will penetrate armor plate as readily as the armor-piercing bullets do at lower velocities. This will be explained later. Also there is a considerably greater effect for automatic bursts when concentrated than for single shots.

Except at very high velocities, the following three factors are of major importance in obtaining an effective armor-piercing bullet: 1. Hardness of core; 2. Form; 3. Stability.

Hardness of core. The core must be sufficiently hard to penetrate the plate at the desired velocity without appreciable deformation, but if the core is made too hard it will shatter as the result of its brittleness. It is possible that at very high velocities a softer core is more desirable than a harder core.

Form. A point on the core is necessary to prevent "skidding." If the point is too thin it will break off; if too hard, it will shatter; if too soft, it will bend or flatten. The shape of point for the greatest efficiency depends upon the type of plate against which it is to be used. The long sharp point is more effective against the soft plate at normal angles of impact. This point, however, against hard plate or at angles of twenty degrees from the normal is not very effective.

Stability. A very small amount of yaw† will greatly affect penetration. Yaw insufficient to show "tipping" on a paper screen will seriously reduce a bullet's armor-piercing ability. As yaw increases slightly, ability to penetrate decreases considerably. If the bullet is approaching zero yaw as it strikes the plate, the effect of yaw on penetration is greatly diminished and in some cases eliminated. If the bullet has just passed through zero yaw as it strikes the plate, the effect on penetration is greatly increased and the bullet probably will be turned.

THE following factors with regard to the physical properties of armor plate are of chief importance with regard to its ballistic resistance: (1) Hardness—to turn bullets if possible; (2) Toughness—to resist cracking or shattering due to impact; (3) Ductility—to prevent buttons or excessive spalling when partly or completely penetrated; (4) Uniformity of grain structure—to insure uniform performance from point to point on plate.

The best representative homogeneous plates which have been tested have approximately 3½ per cent of alloying elements or impurities and 96½ per cent of iron. Chemical compositions which could be enumerated are practically legion, but the alloying elements which have been found to be of most importance in armor plate are chromium, nickel, molybdenum, vanadium and manganese. The effectiveness of armor plate depends not only upon its chemical properties, which must be carefully controlled so as to give the best possible combination of physical properties, but it depends also upon its heat treatment, which is a means of adjusting the structure of steel to a particular purpose by means of application of heat.

The amount of penetration, other things being equal, depends upon the angle of impact. Penetration is, of course, greatest at normal impacts and least when the longer axis of the projectile is approaching parallelism with the face of the plate. Up to angles of twenty degrees, penetration is not seriously affected. If the angle is much beyond forty-five degrees, the bullet will probably ricochet without effect. A rough rule is that the amount of penetration is proportional to the cosine of the angle of impact. For example, at thirty degrees the cosine is .866, and if the projectile would penetrate one inch at normal impacts, it would penetrate but .866 at an angle of thirty degrees.

THE chemical analyses and heat treatments used in the manufacture of light armor-plate steel by various companies differ somewhat, but in general their products seem to be approximately equal. It has been found that homogeneous armor plate of a hardness in the order of 400-450 Brinnell will be quite satisfactory.

The expression "Brinnell" or "Brinnell hardness" relates to a means for the determination of the relative hardness of objects (developed by J. A. Brinnell) which comprises the

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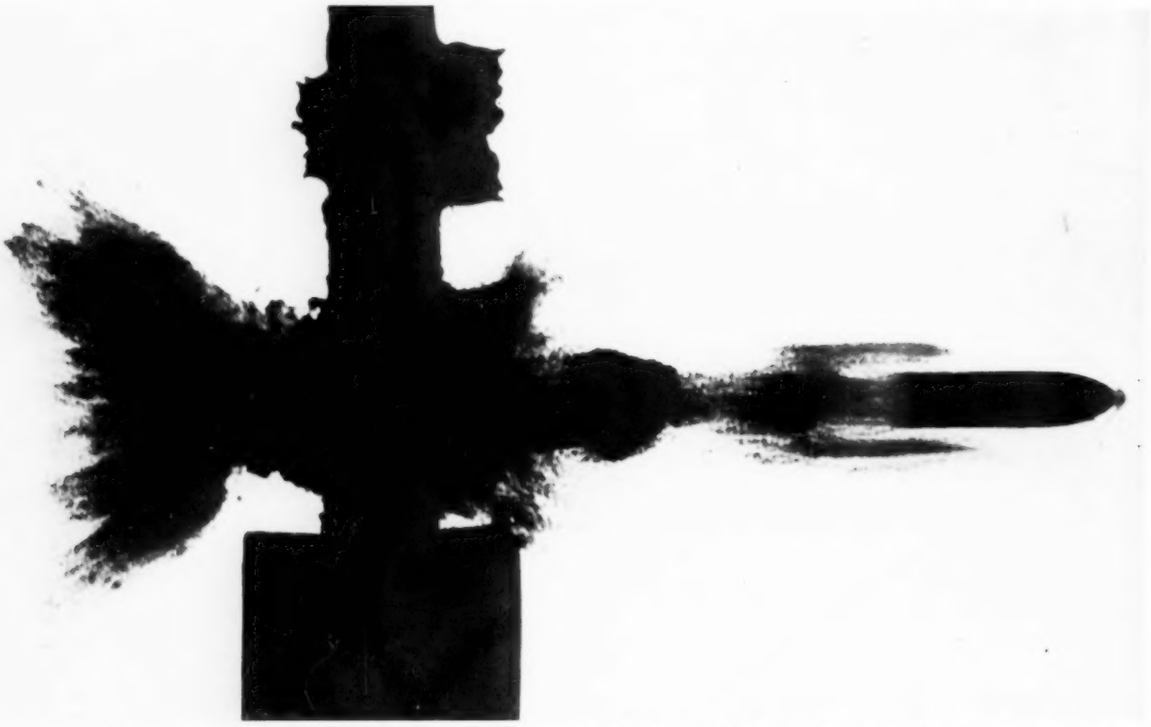
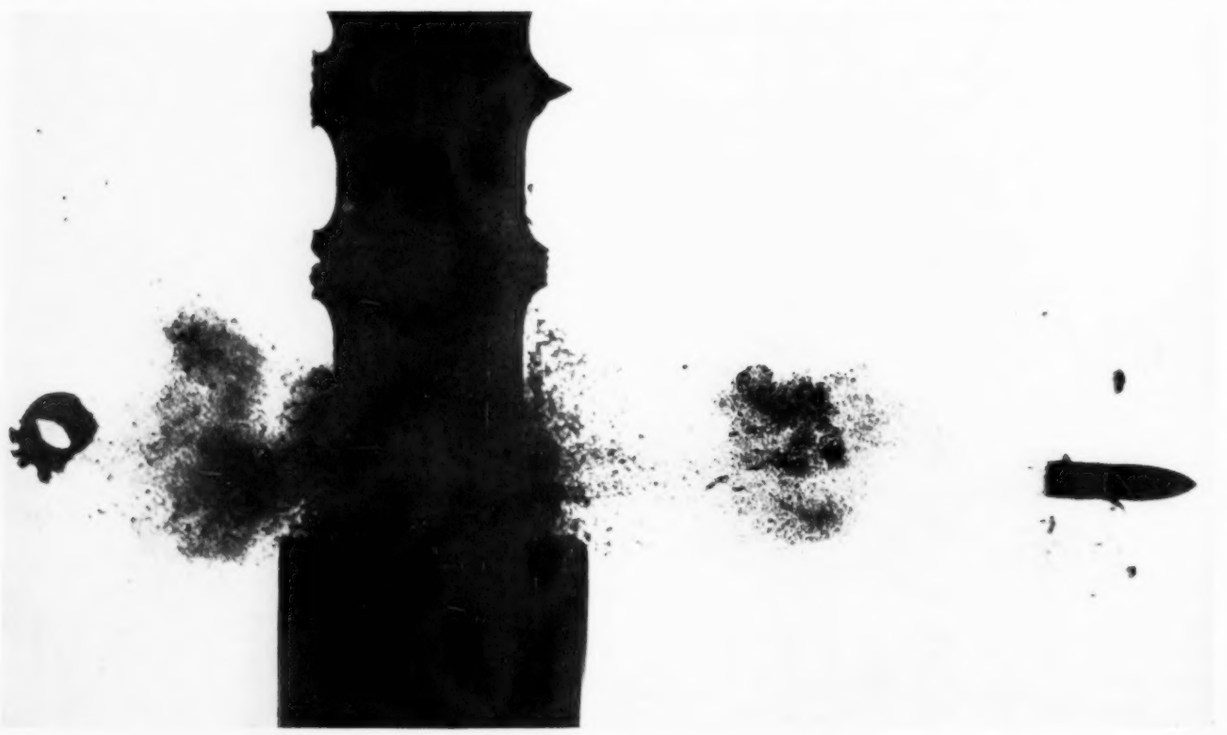
† The trajectory of a bullet is defined as the curved line followed by its center of gravity. Yaw is the "wobble" of the long axis of the bullet about this path. Zero yaw means that the long axis coincides with the trajectory.

Bullet Penetration



These recent photographs from France show the passage of a bullet through a steel plate. Both the punching action of the projectile and the air wave caused by the nose of the bullet are clearly discernible. Spark photography, by which the pictures were made, has been described in earlier issues of ARMY ORDNANCE. *This method of photographing bullets in flight is also explained fully in a new book, "Sound Waves—Their Shape and Speed" by Dr. D. C. Miller, professor of physics, Case School of Applied Science, which is reviewed on page 114. The volume contains a report on investigations made at the Sandy Hook Proving Ground. The photographs on this and the next page were made by Col. Paul T. A. Libessart of the French Army in the laboratory of the French National Office of Research and Invention. They are published here through the courtesy of the Associated Press.*



measurement of the diameter of the impression made by a steel ball on the surface to be tested under the pressure of a known weight for a given period of time. The diameter of the standard ball for use on steel is 10 mm. plus or minus .0025 mm., and the weight applied is 3000 kg. for 30 seconds. The Brinnell number "H" is equal to the quotient obtained by dividing the applied load by a figure which includes the diameter of the ball and the diameter of the ball impression. Brinnell testing is done in a machine designed for the purpose, by means of which the known load may be readily applied to a specimen which rests on an anvil or support in the machine. It is essential in Brinnell testing that the weight applied to the ball shall act in a plane at right angles to the surface to be tested.

The principle of Rockwell hardness testing consists of impressing a hardened steel or diamond point into the surface to be tested and measuring the depth of the penetration, the resistance of the metal indicating the degree of hardness.

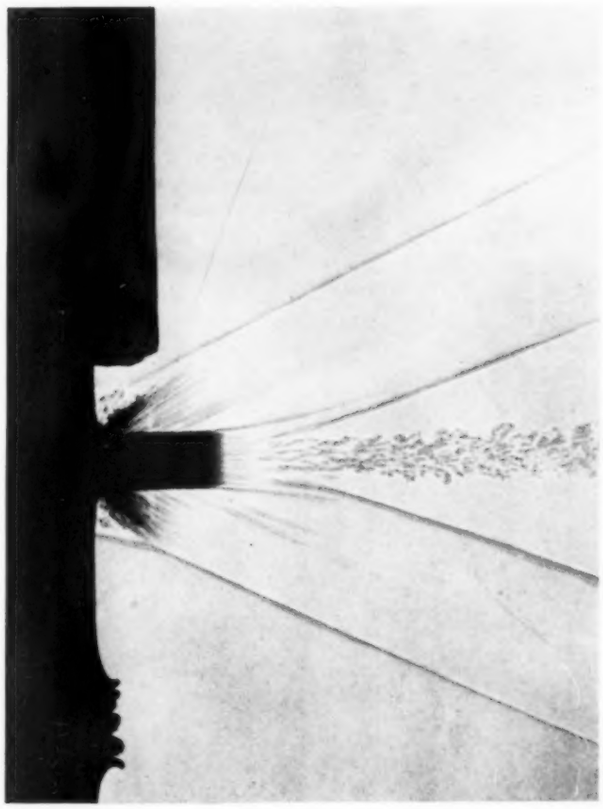
The "scleroscope" embodies another important method. It was invented by F. A. Shore and operates on the rebound principle. The hammer is cylindrical, has a diamond as the striking face, and is contained in a tube which guides it and which also is marked with a scale to measure the height of hammer rebound from a point fixed with reference to the surface to be tested.

It is obviously difficult to compare plates of different thickness which have been attacked by bullets of different calibers. In order that a comparison may be made on a reasonable basis, an empirical formula was developed by De Marre, which has been found to work very well and which takes into account striking velocity, thickness of armor plate, diameter of projectile, weight of projectile, and a coefficient which has been called "K"—known as the De Marre Coefficient. The expression "K" is large or small in accordance with the magnitude of the striking velocity required for penetration, and therefore "K" can be used to compare plates of the same general type but having different thicknesses.

IT will be remembered that steel is in effect an alloy of carbon and other elements in iron. The characteristics of the micro structure (grain sizes, etc.) of steels and their hardness, strength, ductility, etc., are affected by the manner in which the particular steel has been "heat treated." Heat treating, then, is a means of adjusting the structure of steel itself to a particular purpose. For example, it is well known that if steel is heated to a practically white heat and suddenly quenched in water it will be very hard. If it is then subjected to a low heat (temper) the hardness will be modified and the strength and ductility of the steel will be increased. Methods of heat treatment have been developed for particular types of steels and in some cases are very well adapted to the purpose in mind. In the case of armor plate of thin section, heat treatment methods may be said to be still in the development stage.

The chemical properties important in any steel are, in effect, perhaps rather negative than positive, in that it is extremely desirable to have a minimum of sulphur, of phosphorus, and in some cases, of silicon. Otherwise, it normally is not desirable to have too much carbon or too much of any other alloying element. It will be noticed, for example, that in the analysis of some of the best homogeneous plates which have been tested, the total chemical content shows in the order of only approximately 3½ per cent of alloying elements or impurities, the remainder being about 96½ per cent of iron.

The chief difference between light armor-plate steel and that for helmets is that the latter must be designed to withstand the severe working incidental to the deep drawing necessary in the fabrication of helmets. A typical analysis of helmet steel shows, in percentage of composition: carbon, 1.20-1.50; manganese, not to exceed 15; silicon, not more than .45; sulphur, not more than .04; phosphorus, not more than .010. The high manganese content as shown by this analysis is incidental to the use of steel for the deep drawing operation,



PHOTOGRAPH OF A BULLET ENTERING A STEEL PLATE

as it has been found that manganese steel can be worked better and with less rejects when subjected to severe working than practically any other type of alloy. The type of steel used in helmets is very tough but is not so resistant to penetration as some of the other alloys such as have been discussed previously.

Concerning the velocity factor, experiments have indicated that for a given plate and bullet there is a critical velocity at which the bullet will penetrate regardless of whether it be of the armor-piercing or generally standard ball type. It is probable that this critical velocity is that at which the potential energy of the bullet is sufficient on striking the plate to set up a shearing stress therein in excess of the strength of the plate material in shear. The action of the bullet is then similar to that of the punch in a punch press, and a piece of plate is "punched out" just as a piece of paper is punched out of a ticket by the train conductor. Data on the shearing strength of armor plate have not been determined by experiment and the hypothesis indicated in this paragraph is simply an hypothesis because not definitely confirmed. However, results of experimental firings indicate the probability that it is true.

Weapons and the Law

A New Machine Gun Discloses Faulty Legislation

By Ralph Milne Farley*

THE most diabolically deadly machine gun ever devised, and yet a weapon which can be owned with impunity! A weapon which can be carried in a shoulder holster like an ordinary pistol, and which can let loose a stream of lead with a single pressure on the trigger! And yet a weapon which clearly falls outside the definition of "machine gun" in every State and Federal regulatory statute! Such is the Michal fully automatic pistol, on which a patent has recently been granted by the United States Government.

The lesson to be drawn from this patent is an important one which legislators ought to take to heart but probably will not. The lesson is that a too meticulous attempt on the part of the legislature to render a statute ironclad, will often produce exactly the opposite result, and leave the statute full of holes. Courts exist for the purpose of interpreting and applying the law; when the legislature usurps this prerogative by filling a statute full of definitions and instructions for the purpose of preventing the courts from *evading* the legislative will, the result is likely to be that the courts are prevented from *enforcing* the legislative will.

No bill drafter can be expected to be infallibly prescient, and hence no bill drafter should attempt to provide for every possible future event with complete particularity. There is a fundamental principle of interpretation of legal documents—deeds, wills, contracts, statutes—that the express mention of anything implies the exclusion of everything else: *Expressio unius, exclusio alterius,* as the learned jurists say. And so the more particulars with which a legislator loads up a statute in the attempt to catch all offenders, the fewer offenders he usually succeeds in catching. But if he would be content with enacting general principles, the courts could then be depended upon to apply the statute to changing circumstances. Let the Michal machine gun serve as an object lesson to bill drafters!

There is an organization known as "The Conference of Commissioners on Uniform Laws." It consists of delegates from practically all the States, who meet together every year at the time and place of the annual convention of the American Bar Association, to draft and propose uniform laws for adoption by the several States. To them we owe such excellent statutes as the uniform negotiable-instruments law, the uniform sales act, the uniform conditional sales act, etc. But when they came to devise the uniform antimachine-gun law to combat the growing menace of American gangsterdom, they slipped badly.

A large number of States have adopted this law (Arkansas, Connecticut, Maryland, Montana, South Dakota, Virginia, and Wisconsin. Bills are now pending in most other States.) and are now living in a fool's paradise, kidding themselves into thinking that they have thereby outlawed machine guns within their borders. And so anyone would think on reading the following apparently water-tight definition of these lethal weapons: " 'Machine gun' applies to and includes a weapon of any description by whatever name known from which more than two shots or bullets may be discharged by a single function of the firing device"; or, as this definition is usually popularly described in the press: "A 'machine gun' is a firearm capable of discharging more than two shots with one pull of the trigger."

The uniform law makes the possession or use of a (thus-defined) machine gun in the perpetration or attempted perpetration of a crime, a separate offense. The possession or use of one for an offensive or aggressive purpose is made a crime.

Possession or use is presumed to be for an offensive or an aggressive purpose if the machine gun is found on premises not owned or rented by the possessor of the weapon, or if it be found in the possession of an unnaturalized foreigner previously convicted of crime, or if the gun has not been registered, or if empty or loaded machine-gun cartridges are found in the vicinity. The presence of a machine gun in a room, boat, or vehicle, is evidence of the possession of that gun by every person in the same room, boat, or vehicle. Manufacturers and owners of machine guns are required, under severe penalty, to register them. Excellent! But the whole house of cards falls to the ground, and the courts are impotent to convict, if the "machine gun" is *not* a machine gun.

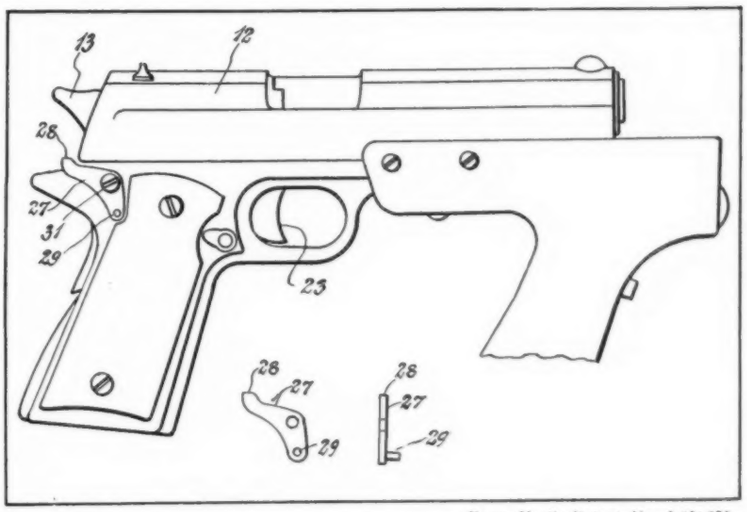
LET us turn now to U. S. Patent No. 2,056,975, issued to Charles J. Michal, Jr., and see what sort of a weapon he has devised. From the pictures and description, it is evident that he has taken the conventional Colt semiautomatic pistol (either caliber .38, or caliber .45) of the U. S. Army, and, by the addition of a simple little gadget, has rendered it *fully* automatic; *i.e.,* what any court, unless hampered by legislative definition, would hold to be a machine gun. A front handle is added to steady the piece during rapid firing. A flashlight beam, to assist in aiming, is also provided, but this feature is not material to our present discussion.

To understand the effect of what Mr. Michal calls his "converter," first let us consider briefly how a normal Colt pistol operates. There is a part (12) called the "slide" which surrounds the barrel (See illustration). When the pistol is fired, the force of recoil throws the slide rearward, thus recocking the hammer (13). During the recoil and counter-recoil, a part called the "disconnector" is forced down into the works, thereby rendering the trigger inoperative. The details of this mechanism need not be described here. Even after the slide has fully returned to its forward position—thereby letting the disconnector come up into a notch on the lower edge of the slide, and thereby releasing the trigger for refiring—even then, the trigger cannot trip the hammer until the finger of the shooter releases the trigger and then squeezes it again.

Here is where Mr. Michal's "converter" (27) enters the picture. This is a simple little bell crank, mounted to pivot on a screw (31) screwed into one side of the pistol near the hammer. On the lower arm of this bell crank is a pin (29)

*Writer of popular fiction, known chiefly for his series of science-fiction stories in *Araosy* and for his "Jim Grant" series in *True Gang Life*. The weapon which is the subject of this article is the basis for the "17-shot pocket machine gun" with which characters in the latter series are equipped.

projecting through a slot into the side of the pistol, and engaging the rear end of the trigger (23). When the slide (12) recoils, it hits the upper end (28) of the bell crank, thus rocking it, and thereby forcing the trigger forward; so that the trigger is all ready to fire another shot the moment the counter-recoil of the slide frees the interrupter and the bell crank. The continued pressure of the finger on the trigger does the trick, without the shooter realizing that his finger is reciprocating to fire each shot. The result is that the gun fires continuously in perfect cadence with each return of the slide, until the magazine (which may be lengthened to contain more than the conventional seven rounds) is emptied.



From U. S. Patent No. 2,056,975

THE MICHAL CONVERTER

THIS operation is not like that sometimes obtained by gangsters who remove the disconnector or file off its top end. For, as the Michal patent says:

"The use of my converter has quite a different result from what would obtain if the disconnector were omitted, and the trigger-slide were lengthened to bear directly against the sear. For, in that case, the sear would merely be held out of engagement with the notch on the hammer, and the hammer would return at counter-recoil, with a force which might or might not discharge the piece. Whereas, in my invention, the hammer is successively cocked and positively discharged. Thus my invention is in no sense a mere undoing of the function of the disconnector, but rather is the adding of an entirely new function and of the mechanism for performing it."

Note that this weapon, which unquestionably *is* a machine gun, does *not* fire more than one shot with each "single function of the firing device"—with each "pull of the trigger." The shooter's own finger unconsciously performs a function which normally would be performed by a part of the mechanism of a machine gun; namely, by a yielding spring between the trigger and the trigger bar. If the Michal gun had such a spring, which it does not, the trigger would be held down during automatic firing, the trigger bar would reciprocate against the spring, and the weapon would *then* fall within the definition of "machine gun" in the uniform act.

The Patent Office has granted Mr. Michal very broad claims for the new principle invented by him. For example:

"4. The combination, with a conventional semiautomatic firearm, of means, consisting of an adapter operatively connecting a recoiling part with the trigger, whereby the movement of the recoiling part will be transmitted to shift the trigger in the release direction against the pressure of the trigger finger of the operator during recoil, and hold it thus shifted until the completion of counter-recoil."

Not only does the Michal machine gun avoid the too particular definition of the uniform antimachine-gun act, but it also avoids the Federal statute as well. For Congress is not immune from the legislative urge to instruct the courts just how to interpret statutes. The definition in the Federal Act is as follows: "The term 'machine gun' means any weapon which shoots, or is designed to shoot, automatically or semiautomatically, more than one shot, without manual reloading, by a single function of the trigger" (quoted from the United States Code, Title 26, Section 1132).

In fact, it is possible that the Michal gun is not even a "firearm", for the Federal act, by defining "firearm" as "a shotgun or rifle having a barrel of less than eighteen inches in length, or any other weapon, *except a pistol or revolver* (italics ours—ED.), from which a shot is discharged by an explosive if such weapon is capable of being concealed on the person, or a machine gun, and includes a muffler or silencer for any firearm whether or not such firearm is included within the foregoing definition" probably still excludes the Michal weapon, which certainly is either a "pistol" or a "machine gun", and being excluded from the definition of "machine gun" must therefore be a "pistol." With such a narrow definition, it is small wonder then that, since the enactment of the Federal act, only *one* weapon of *any* sort has been registered thereunder as a "firearm", as recently reported in the press.

How many forms of deadly weapons have been rendered immune from legal regulation by the meticulousness of Congress and the State legislatures, cannot be estimated. But if the legislators had had more faith in the courts, and so merely had legislated against machine guns, without defining them, leaving definition to the courts, the suppression of gangsters would be more effective. This article is not intended as a suggestion to gangsters that they evade the laws by buying Michal machine guns. Quite likely the courts will have the courage to disregard the express language of the enactments, and thus will hold to be machine guns all weapons which obviously *are* machine guns, even though the legislatures have decreed that they are *not* machine guns. Quite likely a gangster who owns one of these deadly little Michal repeaters, will carry it in a shoulder holster and thus violate the law against concealed weapons, even though technically innocent of violation of the law against machine guns.

But the moral which I wish to point is that the legislatures could better serve public interest if they would make fewer attempts to hamper the discretion of the courts.

EDITOR'S NOTE: Readers will find further enlightening data on the classification of weapons in the hearings on the "National Firearms Act" before the Ways and Means Committee, House of Representatives, April and May, 1934.

The Tanks at Cambrai

The Maxims of Battle Are Not Changed by Mechanization, II

By Fred. H. Wagner*

SEVENTEEN tanks of H battalion proceeded from the Hindenburg support position at 11 A.M. (November 20, 1917) for the attack on Bois des Neuf and Premy Farm; thirteen of these reached their objective, four having been made derelict by direct hits from a German battery. Eleven tanks were observed "dead" in front of Marcoing. Ten tanks passed through the Bois des Neuf toward Premy Farm, while the remainder passed around the farm and proceeded to Marcoing. German resistance was weak at the northern end of Bois des Neuf, and several German machine-gun nests were mopped up between Premy Farm and Marcoing. At about 1:15 P.M., infantry of the 29th Division entered and held the forest. As soon as the infantry was firmly established the tanks retired, having been advised they were no longer required.

Besides the fourteen tanks which had proceeded against Marcoing, the commander of B battalion located sixteen additional tanks assembled about 600 yards southwest of Marcoing. The crews of these tanks had just finished mess, the tanks were in shape for battle and were awaiting the appearance of the 1st Cavalry Brigade with which they were to attack Cantaing and Fontaine-Notre Dame, where German resistance appeared weak. Replacement tanks for B battalion, accompanied by supply tanks, now arrived, but the expected cavalry failed to make its appearance. Further orders for the tank movement also failed to materialize. At this time, H battalion, besides the fourteen tanks which proceeded against Bois des Neuf and Premy Farm, had assembled twelve additional tanks in the rear of the Hindenburg support line.

The 51st Infantry Division was stationed on both sides of Trescault, the right being formed by the 153rd Brigade with E battalion, while the left wing was composed of the 152nd Brigade with D tank battalion. The front selected for the attack was the Ribécourt-Flesquières line. Here the tanks attacked with eighteen in the first wave and fourteen in the second. The distance between the separate tanks of the first wave at the beginning of the attack varied between thirty-five and fifty-five yards. The tanks intended for the cutting and removal of wire obstructions preceded the first wave by 140 to 150 yards. Here occurred one of those incidents which are always open to question. The Germans state that a lone artillery officer at Flesquières, with a single gun, caused serious damage to the tanks of H battalion, the number of tanks destroyed by this one man varying between ten and sixteen. This statement, as is natural, is challenged by the British. B. H. Liddell Hart, in "The Real War" (page 352), says of this incident: "It must go in the catalog of historic legends, for only five derelict tanks were to be seen at this point after the attack had moved on, and an intelligence officer who examined the ground found marks which showed clearly that three batteries had been in position there to engage the tanks. It is possible that all save one gun, and one gunner, had been silenced, as was claimed, but impressions in the heat of battle are somewhat misleading."

The attack on Flesquières came to a halt at 9:30 and failed to recover. The tanks advanced far into the rear on both sides of the town, but Flesquières held fast. This town lies near the top of a slope leading to a broad ridge; a Pioneer depot, plentifully supplied with hand grenades, lay southwest of the town; one light field battery was stationed to the north, one to the east, and three to the south. Besides these, the town also could receive protection through six light- and three foot-artillery batteries located at Graincourt about 2200 yards away, as well as through five light batteries located about the same distance away northwest of Marcoing. About half of these guns were destroyed by British artillery fire. Flesquières was held by parts of the 27th Reserve Infantry Regiment, by Pioneers, and by retreating men of the 47th Infantry Regiment.

The town was attacked by the 153rd Brigade with the thirty-two tanks. It was still foggy when the tanks advanced up the heights, but they hardly had reached the top when they were subjected to short-range artillery fire, and the advance came to a halt. The British started to renew the attack in conjunction with tanks advancing on the left wing. The fog, however, lifted at 9:30 and the tanks advancing from Graincourt and Marcoing were repulsed, finally compelling the infantry to abandon the attack after more than half the tanks had been destroyed.

In the sector of the 62nd Division, battalion G had been assigned to the 185th Brigade; two or three tanks attacked the village of Havrincourt while the remainder went forward against the neighboring German trenches. The arriving infantry consolidated the captured positions and the 186th Brigade passed through the town and proceeded in the direction of Graincourt-Anneux, crossing the Cambrai-Bapaume road. Then the 185th Brigade relieved the 186th.

After the tanks had broken through the positions at Havrincourt, they struck at the open German flank and passed along the trenches of the last position. They then wheeled to the north and passed through the positions east of the canal in the direction of Graincourt. Six derelicts were found in front of the German lines southwest of Graincourt, and from this it was assumed that the attacking battalion had met with severe losses. The right wing of the 36th Division adjoined the left of the 62nd. The 36th was ordered, after the 62nd should have taken Bourlon and Bourlon Forest, to proceed in a northerly direction and take Mœuvres; due, however, to the reverses experienced earlier by the 62nd, this order was not carried out. Attempts made by the 36th Division to take Mœuvres on and after November 22nd were beaten off with heavy losses.

Rainy and cloudy days, with the employment of every possible means to obtain secrecy, accompanied by mass tank attacks, brought victory to the British through *complete surprise* on the first day of the battle; on the 21st, however, British arms were already encountering stiffened resistance.

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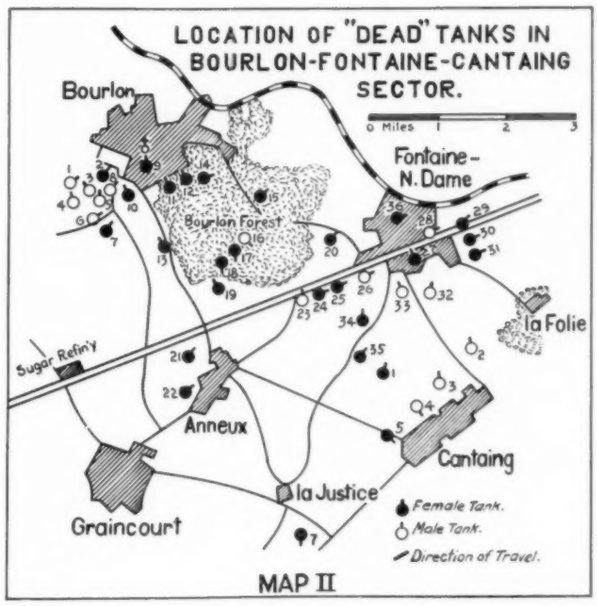
AS ON the first day of the battle, the British again attempted to place their main efforts on the employment of tanks, entering most of them in the Marcoing-Bourlon sector. The Germans are, however, unable to state positively the assignments of the various tank battalions, but assume that the groups were being constantly changed, because at Bourlon and at Fontaine-Notre Dame, derelict tanks of all battalions were found within the German lines.

On the afternoon of November 21st a tank attack was launched on the German positions in the direction of Révelon Farm, southwest of Crevècoeur, but this was repulsed. Toward 1 P.M., tank sections were observed coming from Marcoing and proceeding in the direction of Rumilly and Flot Farm. The first attacks on these points were repulsed, but later several tanks of the 7th section of the 17th company, F battalion, broke through and proceeded on the road toward Cambrai. German counterattacks compelled these tanks to retreat. Three derelicts, the A-3 (55), F-W-1 and one, the markings of which were undecipherable, were located in this battle sector, shown on Map I, Part I (July-August issue, p. 28).



MAP II

The 2nd Tank Brigade attacked Cantaing, Fontaine-Notre Dame and Noyelles on the 21st. Orders had been received at brigade headquarters in Dessart Forest at 5:30 A.M. for three tanks to operate in conjunction with the 154th Brigade of the 51st Division. The tanks of this brigade were about five miles distant in the neighborhood of the Grand Ravine, between Havrincourt and Ribécourt. Toward 8 A.M., H battalion received orders to proceed against Fontaine-Notre Dame with twelve tanks from B battalion one hour later. Both battalions were compelled to travel a distance of several miles before reaching the positions from which the infantry was to advance. Time was lacking for the establishment of communication with the infantry, the latter having been assembled on the line running east and west of la Justice Farm with orders to attack at 10 A.M.

Due to their late arrival, it was 12:30 P.M. before the tanks of B battalion forced their way into Cantaing. The village was taken after severe fighting, and the on-storming infantry took over half an hour later. At the request of the commander of B battalion, a squadron of the 2nd Dragoon Guards had joined the battle and was of great assistance to the tanks through an attack from the east. The tanks of H battalion arrived in front of Cantaing at about 4:30 P.M. after a march of three miles. Several severe engagements were fought in the neighborhood of Cantaing Hill, and between there and the village. Two derelicts, the B-38 and C-48, were found after this action at Cantaing, and another, the B-8, was located southwest of the village.

Upon the urgent request of the 86th Infantry Brigade on the afternoon of the 21st for tanks to assist in the attack on Noyelles—since the infantry was being held up there by heavy machine-gun fire—a group commander of B battalion, whose tanks were in the neighborhood of Grand Ravine, upon his own initiative started out to give the assistance requested and arrived before Noyelles with two tanks. These tanks broke the German resistance and then patrolled the roads until after the infantry took over the village half an hour later; the tanks then returned uninjured to their filling station during the night. German artillery fire had compelled these tanks to take a zigzag course in approaching the village, and thanks to this they had no losses.

The 62nd Division, supported by numerous tanks and covered by smoke laid down by the British guns, advanced in the sector on both sides of Graincourt toward Anneux and the sugar factory. They attacked in the direction of Bourlon and Bourlon Forest. Before the tanks reached Bourlon, they met a German counterattack and were held up. At 4:30 P.M. the tanks advanced and repeated the attack, but this came to an end on the southwest edge of Bourlon Forest.

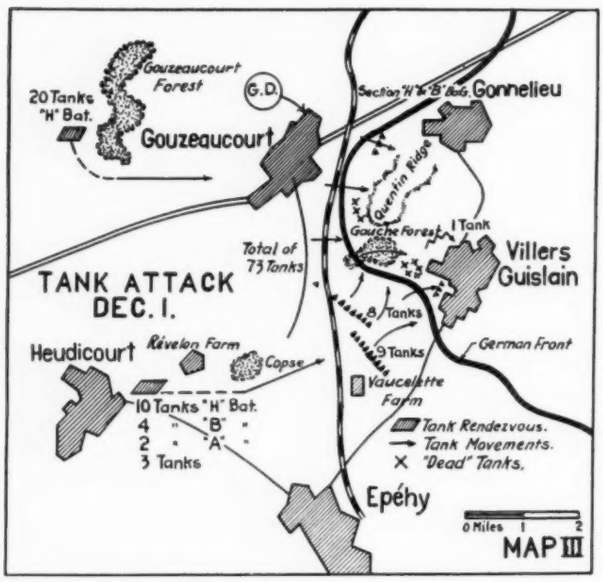
On this second day of the battle it was again impossible for the British to obtain a decisive break-through of the German front. British headquarters now ordered all further tank attacks to be made in the sector between Bourlon and Fontaine-Notre Dame.

During the night of November 22nd-23rd, the 40th Division entered the battle: the 119th Brigade was to take and hold Bourlon village, and the 121st Brigade the neighboring forest. The 152nd Brigade of the 51st Division, together with twelve tanks of H battalion and twelve from B battalion, was assigned to an attack on Fontaine, which had been retaken by the Germans on the 22nd, as well as an attack on the eastern edge of the forest. At 6:30 P.M. the tanks, together with the accompanying infantry, were assembled in the narrow defile which passes east and west through la Justice Farm. The time for the attack was set for 10:30 the next morning. The 9th section of the 27th tank company, J battalion, was in the depression south of Fontaine prepared to advance. This section was, however, in the line of fire from the German artillery, hence it was withdrawn from this position at dusk and sent toward Fontaine. One of these tanks became bogged in a water hole near the village; it had to be abandoned and its crew fell into German hands. The remainder finally succumbed to German gunfire in the following battle.

The tanks, covered by heavy smoke, attacked Fontaine, but not before the B-23 and B-24 became derelict south of the village—the one suffered a breakdown and the other a direct hit. The remainder passed on and entered the village street, but without avail, since the German artillery, field guns mounted on trucks, and mine throwers accounted for

numerous derelicts. Eighteen tanks were found "dead" in and around Fontaine, eleven of these having received direct hits.

The attack of the 49th Division at 11:30 A.M., led by a wave of thirty tanks, had Bourlon for its main objective. During the attack, a tank of section 4, company 13, of E battalion, directly in front of the German position in Bourlon Forest, received a direct hit in its fuel tank. It rolled on



for a few yards and then was destroyed by the explosion of its benzine. Additional tank concentrations were observed in the Graincourt-Anneux area, but these failed to join in the battle.

ON NOVEMBER 24th the 40th Division renewed the attack, the troops having been augmented by dismounted squadrons of the 1st Cavalry Division; this attack also was accompanied by tanks. Eight tanks were observed on the western edge of Bourlon Forest, and these forced a passage through the woods toward Bourlon. Here tank J-56 was destroyed; consequently the Germans surmised that tanks of J battalion had entered the action, since five additional J tanks were later found "dead" in this sector. A large number of tanks, estimated at forty by the Germans, were observed in the vicinity of Graincourt on November 25th, but all local engagements fought on the 25th and 26th were without tank support.

On November 27th, the British again sent the 62nd and the Guards Division into the battle. These were supported by numerous tanks and they advanced against Bourlon and Fontaine at 7:50 o'clock. A portion of the tanks broke through the German position between Fontaine and Bourlon Forest. These tanks advanced through the woods along the road connecting Bourlon and Fontaine (Map II), a tank attack being made on Bourlon village at the same time. Due to the excellent fire of the German artillery quite a number of the attacking tanks were made derelict. This attack also was repulsed.

A large number of "dead" tanks located near Bourlon bore the letter F, hence the Germans rightly surmised that F battalion had taken part in this action. The number of tanks made derelict in this battle sector between November 22nd and 27th was of such magnitude that German troops could readily claim having placed many of the derelicts in and around Bourlon out of action. The derelicts located in this sector and numbered on Map II were:

No. 1. Not decipherable	No. 13. 28	No. 25. H-45
" 2. F-31	" 14. G-45	" 26. F-41
" 3. F-5	" 15. C-2	" 27. C-47
" 4. F-27	" 16. F-6	" 28. B-28
" 5. F-30	" 17. Not decipherable	" 29. B-57
" 6. F-2	" 18. Not decipherable	" 30. B-4516
" 7. F-21	" 19. C-5	" 31. B-30
" 8. I-56	" 20. C-53	" 32. B-23
" 9. F-W-3	" 21. I-58	" 33. B-24
" 10. I-26	" 22. I-36	" 34. J-32
" 11. F-13	" 23. H-48	" 35. B-45
" 12. F-4	" 24. H-46	" 36. Not decipherable

In addition to these, there were derelicts—marked on the map as 1, 2, 3, 4, and 5—directly north and west of Cantaing, and No. 7 south of la Justice Farm. The designations of these were not decipherable.

A considerable pause occurred in the activities on both sides on November 28th, appearing that both were calling a halt in hostilities, but this was not to endure for long.

The surprise attack by massed tank squadrons at Cambrai brought the British a unique initial success. The powerful attempt to break through and destroy the German lines of communication in the rear during these days of continuous battle was, however, not successful; it had been partly shattered and held up by German resistance. The conquered territory was in no wise commensurate with the large sacrifices in tanks made by the British. Of about 436 tanks which initially were on the field, seventy-five were found derelict within the German lines, and thirty-two no longer mobile were observed by the Germans in front of their lines. This indicated a loss of twenty-five per cent of the total tank power. If the additional number of immobile or unidentifiable tanks, or those dragged from the field, be considered, another one hundred tanks, according to German estimates, should be added to the above identified losses.

In consideration of the character of the 1917 tank, it is fair to state that during the initial attacks on the German lines, as well as in the following actions, these tanks performed their duty faithfully. In such tanks, with rigid suspension, badly ventilated, with the engine in the fighting compartment, and with the constant expectation of engine failure, life was a veritable hell which, during attack with all ports and doors tightly closed, could not be endured long—the men of the crews becoming "seasick," if not even unconscious. Their tasks were the removal of obstructions and the destruction of enemy machine-gun nests and infantry strong points which they successfully accomplished during the surprise days of the battle.

No one will dispute the fact that a complete strategical and tactical surprise was achieved in the attack, since, covered by a heavy smoke barrage, the British promptly rolled over the German positions. With the coming of night on the first day, the British had crossed the Escaut River at Masnières and had occupied a portion of the German position. On the following day the British line was consolidated up to the German first line, where lodgements had been made, and where the cavalry, passing through the breaches, reached the outskirts of Cambrai. But both the tanks and the cavalry failed to exploit the German rear. General Haig's forty-eight hours had expired, and failure to

capture Bourlon Hill remained a menace to his troops. Haig decided to continue the offensive with the hope that the Germans would withdraw, and that German pressure on Italy might thereby be relieved. Haig, however, failed to have his three infantry divisions at Bapaume roll back the inner flank of the German north wing, and he also failed to give any orders at all to the French divisions, under Degoutte at Péronne, to enter the battle. In fact, Degoutte had been informed, after the first day, that his forces were no longer required. This failure to employ the French troops probably was due to premature confidence in an early victory after the first day's battle. It is reported that Haig was informed of the approach of German reënforcements, but he remained content to limit his future actions to the high ground at Bourlon. He also failed to organize the salient in depth—for which he was to pay later.

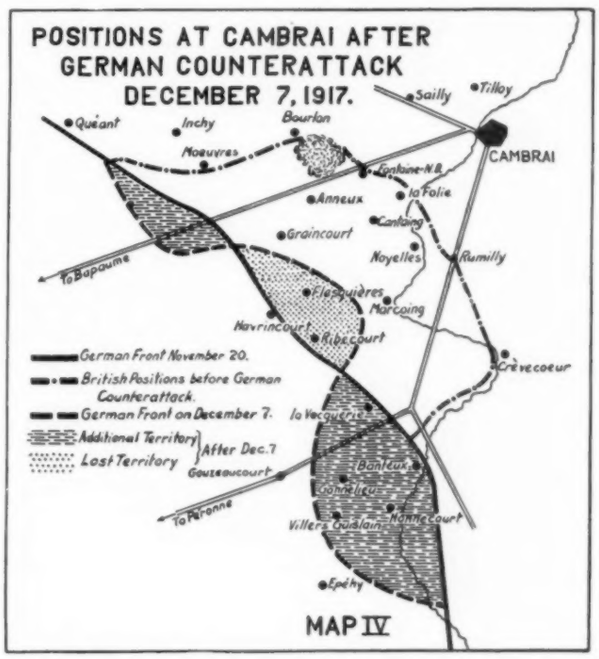
THE German command lost no time in preparing a counter-offensive. General reserves were ordered into the area and divisions intended for the Italian front also were shifted to Cambrai. Since relief for the Italian front was the reason for the Cambrai offensive, the Allies' hopes were realized in that they obtained other employment for German troops intended for another thrust against Italy. They failed to realize, however, that these same troops would be employed against them at Cambrai.

German reënforcements began to arrive in the area on November 22nd. In fact one fresh German division arrived on the 20th and took position in the rear line of defense. The Crown Prince of Bavaria, who was in command on this front, lost no time in employing all available troops to stop the British advance, after which he planned to reduce the enemy salient by a converging movement with four divisions in the northern force and seven in the southern force. Exactly ten days after the beginning of the British offensive, on November 30th, the German troops, *without the support of tanks,* struck the British line. This time it was the British who were surprised!

The northern attack was held, but the southern one pushed a wedge into the British line and reached Gouzeaucourt; this town was retaken by Byng with one infantry and one cavalry corps assisted by sixty tanks. Two days later the German northern force renewed the attack and after five days of battle pressed the British line back to Flesquières. In the sector between Banteux and Vendhuille the German attack pressed on as far as Villers Guislain. This thrust produced a deep salient in the British front and compelled Byng to bring up his reserves to combat the threat. The tanks were compelled to go forward once more to support the infantry attack.

At 9:55 A.M. on November 30th, headquarters of the 2nd Tank Brigade in Templeux la Fosse received a telephone communication from the Third Corps announcing that the Germans had forced the British line backward, and that all tanks would at once be prepared to attack the enemy in the vicinity of Gouzeaucourt. The battalions received their orders by telephone, and the brigade staff immediately left for Fins, where headquarters were established at 10:30 A.M. The tank forces had become so depleted during the ten days of battle that the British had only seventy-three tanks at their disposal. These were assembled at Fins, where the greater portion of them had arrived the day before and were ready for loading on railroad cars since it was thought they no longer would be required on this front. Runners were sent out to gather in all officers and enlisted personnel, and these immediately set about preparing the tanks for battle.

At 12:40 P.M. twenty-three tanks of B battalion departed from the tank park; fourteen tanks of A battalion followed shortly afterward. The B battalion tanks were ordered to attack Gouzeaucourt from the south and southwest; if upon arrival at the village they found the place in British posses-



sion, they were to occupy the town in conjunction with the infantry. When it was learned that a British Guards Division had retaken Gouzeaucourt, several tanks were left at support points while the remainder assisted the infantry in holding the territory adjacent to the town.

German artillery fire destroyed five tanks by direct hits. The crews of derelict tanks now became machine gunners, removing the guns and ammunition from the tanks and organizing several machine-gun posts on the western side of Révelon Farm. The remaining tanks gave the cavalry excellent assistance in their flank attack from Révelon Farm. There is no doubt but that the appearance of the tanks at the critical moment had an immense effect on the morale of the British troops. After dark the tanks which were still mobile assembled to the west of Gouzeaucourt.

Fresh crews replaced the exhausted ones during the night, and orders were issued to have all tanks in shape for instant attack should the engagement be renewed. Twenty H battalion tanks left the tank park at 2 P.M. and proceeded to Queens Cross, the heights directly east of Gouzeaucourt Forest, where they were assigned to the Guards Division.

The battle was renewed on the morning of December 1st (Map III). A provisional company of ten tanks from H battalion, two from A and four from B battalion had been formed on the night of November 30th and was ordered to assist the 4th Cavalry Division in the attack which was to start at 6:30 A. M. on December 1st against Gauche Forest and Villers Guislain. This composite tank company was assembled in the vicinity of Révelon Farm, where three more tanks, which were at that point, were added to the force.

THE plan of attack, as worked out in conjunction with the 5th Cavalry Division, was as follows: Eight tanks were to start at 6:10 A.M. from Ganin Well Copse, the small forest east of Révelon Farm, with orders to assist the Umballa Brigade in the attack on Gauche Forest. The remaining tanks were to advance from the vicinity of Vaucelette Farm and assist in the attack of the Lucknow Brigade on Villers Guislain. After these objectives had been taken the tanks were to proceed to Villers Ridge, east of Villers Guislain, and there support the attack of the 4th Cavalry Division.

Due to a belated arrival at Révelon Farm, it became impossible to send tanks to Vaucelette Farm previous to the hour of attack, hence it was decided to have all tanks start from Ganin Copse. The Umballa and Lucknow Brigades and the 5th Cavalry Division were advised of this change in plan at 4:50 A.M. At 6:10 A.M. seventeen tanks left Ganin Copse, the remainder being left behind on account of breakdowns. Eight tanks proceeded against Gauche Forest, and nine against Villers Guislain. The latter, however, since they were compelled to pass Gauche Forest on the way to Villers Guislain, became involved in the fight at the forest. German machine-gun nests on the way to the forest were wiped out.

The tanks proceeding against Villers Guislain were subjected to heavy artillery fire, but despite this, three of them reached the outskirts of the village, the others approaching the latter to within 300 yards. The road which the tanks had approximately followed passed over the southern edge of the forest and toward the western corner of Villers Guislain. One tank, which was under heavy artillery fire, took a zigzag course and attempted to reach the northwest side of the village. This attack on Villers Guislain was not supported by artillery fire, presumably on account of a change in the plan of battle. Seven tanks withdrew and reassembled. The attack had been repulsed.

Twenty tanks of H battalion had, on November 30th, been brought to the neighborhood of Queens Cross, east of Gouzeaucourt Forest, with the object of having them operate in conjunction with the Guards Division. On the same night, this division received orders to attack Gonnelieu, Quentin Ridge southwest of Gonnelieu, and Gauche Forest. An officer of D battalion of the 1st Tank Brigade informed the division that his twenty additional tanks were prepared to assist in the attack. It was therefore decided that these tanks, with the three Guards brigades, should attack Gonnelieu and the eastern portion of Quentin Ridge, while the twenty tanks of H battalion, in conjunction with the 1st Guards Brigade, should proceed against the southern portion of the ridge and Gauche Forest. However, toward 4 P.M., the command of H battalion, while at the headquarters of the 1st Guards Brigade, received telephone advices from the commander of D battalion that only four of his tanks were in shape to attack. This caused a change in plans, and it was decided to have a section of four tanks from H battalion make the attack on Gonnelieu in conjunction with the Welsh Guards of the 3rd Brigade.

Due to the short time available, this order reached the tanks after they were already on the road; consequently it was impossible to join up with the designated infantry; besides, the point selected for the attack was not a favorable one for tanks. Two of the tanks got into a fight on the north of Quentin Ridge, and one of these was of material assistance to the Welsh Guards who were held up by heavy machine-gun fire from the foremost German trenches. This tank maneuvered up and down the trench, which it enfiladed, permitting the Welsh Guards to advance and take the trench (Map III).

As previously stated, the British entered seventy-three tanks in the engagements at Villers Guislain and Gauche Forest on December 1st. A large number of these succumbed to German artillery fire and the tanks again failed to bring about a decisive British victory. The engagements up to December 7th brought further success to the Germans, and the territory initially lost by them between November 20th and 23rd was regained in great measure, and even additional territory, as shown on Map IV, was taken, as also were many prisoners, guns, and ammunition.

THE battle of Cambrai, which had opened with phenomenal success *occasioned by surprise,* broke down through a *counter-surprise,* and the British sustained a defeat which produced unpleasant repercussions in England. The bells of London on November 20th had been premature in announcing a victory. One excuse for the defeat is given by Liddell Hart: "The fundamental weakness of the general plan, however, was not topographical, but the complete lack of reserves—unless the two cavalry divisions can be considered such; and the futility of so regarding them was amply shown in their fresh inability, in face of modern weapons, to influence the action." I assume that Captain Hart has reference to machine guns and the like when he refers to modern weapons in the hands of the enemy, but on the other hand, when the Germans had succeeded in gathering sufficient forces in place of the weak ones which originally held the line, they also met modern weapons in the form of tanks. Despite the possession of the latter, the British ultimately sustained a defeat after sacrificing the greater portion of these weapons in gaining the conquered positions and in attempting to hold them when the counteroffensive hit them.

With reference to the lack of reserves, it may be pertinent to inquire why Degoutte with his two infantry and two cavalry divisions had been informed after the first day of battle they would not be required. These certainly would have been of inestimable value when the critical moment arrived; but they were not called upon, probably because the initial British success had made them overconfident.

It only remains to refer to the "balance sheet" as it appeared on December 5th, when prisoners and matériel captured by each side were reported to have been:

	Prisoners	*Machine guns*	*Guns*	*Tanks*
German	9,000	716	148	100
British	10,500	350	142	...

After an examination of reliable Allied sources of information pertaining to this action, I found many of my conclusions embodied in "Der Kampf gegen Tanks," by Maj. M. Borchart, a German officer who had the privilege of examining the field immediately after the storm had passed, and who, from personal observations and from orders and directions taken from British prisoners, tells his story as the Germans see it. I have quoted freely from this book because I feel the other side of the story should be publicized, permission for which was accorded me by the publishers, Verlag von E. S. Mittler & Sohn, Berlin. (*Concluded.*)

ARMY ORDNANCE

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SEPTEMBER-OCTOBER, 1937

Month by Month

THE Army and American industry welcome Col. Louis Arthur Johnson of Clarksburg, W. Va., who assumed the office of the Assistant Secretary of War on June 28th. His appointment to this post, which had remained vacant since Secretary Woodring became the Acting Secretary, and later Secretary of War, following the death of Mr. Dern, is particularly auspicious in view of the many problems with which industrial-mobilization planning is faced. It should be remembered that the three main responsibilities of the Assistant Secretary are the management of current procurement of all supplies for the Army, the supervision of the Army Industrial College, and the direction of industrial-mobilization planning. Each of these is a responsibility of high order, but the last, that of planning for military supply and industrial coördination in time of war, is far and away the most vital. That the new civilian head of these activities is a man of vigor and application augurs well for their advancement under his guidance.

ASSISTANT SECRETARY JOHNSON

Colonel Johnson has had broad experience with both the military and industrial problems of our national defense. His military career began as a civilian candidate for a commission with the 9th Infantry at Fort Benjamin Harrison, Ind., in 1917. In November of that year he was commissioned a captain in the Infantry Section of the Officers' Reserve Corps. He reported for duty with the 80th Division, Camp Lee, Va., where he served with the 42nd Company, 11th Training Battalion, and the 18th Company, 5th Training Battalion, of the 155th Depot Brigade until March 1918, when he was transferred to the 305th Ammunition Train. He was appointed adjutant of the 305th Ammunion Train August 21, 1918, and with this organization participated in the Meuse-Argonne offensive. He was honorably discharged from the Army after his return to the United States when he was appointed a major, Infantry Section, Officers' Reserve Corps.

In civil life he has taken an active part in the affairs of his state and city. He has served in the West Virginia legislature and as a practicing attorney. He has been identified with many of the commercial interests in his native state. He was National Commander of the American Legion in 1922 and 1923.

He is a firm believer in the modernization of the military organization, particularly as it relates to air defense. He is now familiarizing himself with the duties and functions of current procurement and industrial preparedness. Later he plans to visit service installations and, we hope, the industrial components throughout the country. He comes to an office already in a high state of efficiency. Industrial-mobilization planning during recent years has been developed both in theory and practice to the point where its plans and policies have the enthusiastic approval of the Army as a whole, the Navy, and industry. He finds the Army Industrial College under competent leadership manned by a staff of Army and Navy officers the equal of any faculty of postgraduate studies in the land. Its curriculum leads the way to effective knowledge for our military and naval component. He finds current procurement operating smoothly and effectively in the daily conduct of its vast operations. To both he can render a splendid service by sustaining the major principles and policies of time-tried value, by improving where improvement can be made, and by stimulating the zeal of the men in military life who are responsible for, and those in civil life who are coöperating with, industrial preparedness.

What the future holds in the way of military demands upon the United States is unknown. With us the problems of defense are not as pressing and, as a result, the paths not as clearly indicated as they are for some other major powers. The American concept of national defense is the philosophy of the open mind backed by logical plans for immediate application and of reasonable soundness. In the industrial phase of our national defense particularly does this philosophy apply. To Colonel Johnson comes the honor and the responsibility of leadership, and we are confident that he will make the most of it.

EFFORTS to deal a body blow to the national defense of the United States by the nationalization of arms manufacture are still being made by some of our national legislators. Representative George D. O'Brien of Michigan introduced in the House of Representatives a bill (H.R. 4962) which would restrict the manufacture of military and naval equipment to the War and Navy Departments. Similarly, five senators, Messrs. Bone (Washington), Clarke (Missouri), Nye (North Dakota), Pope (Idaho), and Frazier (North Dakota), sponsored a bill in the Senate (S. 2603) to provide Government ownership and operation of shipbuilding facilities and plants for the manufacture of Army and Navy ordnance and other war materials.

NATIONALIZATION OF ARMS

The War Department frequently has declared its position on this subject, notably in the comprehensive statement presented to the Special Committee for the Investigation of the Munitions Industry in 1935 (ARMY ORDNANCE, Vol. XV, No. 88, January-February 1936, pp. 201-205). Hence when Congressman O'Brien's bill was referred to it, the Department again condemned nationalization in the following words:

"It is apparent from the title and preamble of the bill H.R. 4962 that the intent of the bill is to stop all private manufacture of munitions of war. The War Department is opposed to such nationalization of the munitions industry for the following reasons:

"The War Department recognizes that, in the event of war, it must depend on privately owned manufacturing facilities for the greater part of its munitions requirements. The volume of arms, ammunition, and implements of war needed for major modern warfare will require the conversion to military production of a substantial fraction of the nation's whole industrial structure.

"The very large first cost, rapid obsolescence, maintenance cost, waste and duplication attendant upon any attempt to acquire and keep in stand-by condition arms and munitions-manufacturing plants sufficient to meet the needs of the military forces at war make such a project prohibitive.

"Government monopoly of munitions-manufacturing facilities sufficient to meet the peace-time requirements of the armed forces is, of course, feasible, but such a policy would not obviate the necessary dependence of the War Department upon privately owned manufacturers for the great part of its war-time requirements.

"It follows that the policy now pursued by this Department of obtaining, wherever possible, arms, munitions, and equipment from privately owned sources is sound on the principle that such organizations or industries, having produced munitions in time of peace, will be able to do so in time of war with greater efficiency and rapidity.

"In considering legislation such as is proposed in H.R. 4962, attention must be given not only to the expense of obtaining and maintaining the requisite manufacturing facilities, but to that of securing and maintaining the increased war reserves required by the resulting addition to the war-time need to reach full munitions-production schedules.

"The War Department is in no way opposed to the principle of control by authorization or license of the munitions industry, but it does oppose the establishment of Government monopoly of that industry, and it is therefore recommended that the bill H.R. 4962 be not enacted into law."

This is a clear, logical, and convincing restatement of War Department and Navy Department policy. It applies with equal force not only to Mr. O'Brien's bill but to the Senate proposal as well.

Are the Wells Dry?

SOME students of military affairs in the United States view with a sense of chagrin the scarcity of our general military discussion. As the years go on they hear less and less of sound debate, they know less of productive research and they read less of free expression of the military and naval problems which confront us. The condition is not animating. More important is the unfavorable result as far as general popular understanding is concerned. Such a situation, if we appraise it correctly, means that accurate information too frequently is lacking, and that constructive thinking, both military and civilian, too often is following the law of diminishing returns.

Among us today are hundreds of versatile military thinkers who are qualified to express their opinions. But the benefit of their learning is not given to others, or when given, does not create the interest and discussion it deserves. A case in point is that of General Hagood's book published earlier in the year entitled "We Can Defend America". We have said before in these columns that we are not entirely in agreement with the General's theories. Nor should it be expected that an expert's analysis of an exceedingly broad problem will meet with the enthusiastic approval of all critics. But many of the conclusions in General Hagood's book are sound; many of the solutions proposed are simply common sense applied to our military needs. Such a book ought to be, if we are striving for sound military thinking, the basis of much constructive discussion. Except for the notices published in the weekly book reviews of our larger daily papers and in a few of our military publications, including Army Ordnance, scarcely a word of debate has appeared either to show that any one of the Hagood proposals is entirely right or entirely wrong. One might imagine that a great military leader had not spoken—so eloquent is the silence.

Now what matters most is that knowledge of military affairs and progress toward proper conclusions can come only by accurate, comprehensive analysis. Without this method of thought our thinking becomes stagnant, our procedure bureaucratic and, above all, our people develop an arm's-length attitude toward our national defense. What our Army and Navy are doing, and why, become unknown quantities to them and in the end a wall of ignorance or at least of misunderstanding develops which keeps the two elements—military and civilian—miles apart when they must be closely joined. For our part we regret the lost opportunity for enlightenment which followed "We Can Defend America."

The "Streamlined" Division

GREAT expectations arise from the forthcoming maneuvers of the Fourth Army. For the first time under realistic conditions of modern warfare the new "streamlined" infantry division will be under test. It will present an organization much reduced in size yet of greatly increased mobility and fire power. The latter advantages are the result of mechanization, motorization of vehicles and modernization of weapons. It will consist of three infantry regiments supported by one 4-battalion regiment of light artillery. It will have no field trains—extra trucks being supplied from corps pools when needed.

In tactical maneuver the provisional division will have many modern features. It will use scout car platoons for reconnaissance and security in advance of the main body. Equipped with machine guns and 2-way radio, these platoons with armored cars will travel well in advance of the division to cover with great rapidity important observation points. They will be in constant touch with division headquarters by radio.

From the study of these trials data will be assembled for final decision as to the size and organization of the infantry division. The Chief of Staff has said that the strength may ultimately be reduced to about 12,000 men. It is quite apparent that whatever the final decision on this point may be, the importance of modern weapons, the increase of mobility and fire power will place added significance upon the development, production and maintenance of ordnance. At the same time, in conformity with the trend of a technical age, burdens will be transferred from human beings to machines.

Men or Matériel?

An Editorial

THERE is superb good sense in standing off from time to time to take an objective view of the military policy of the United States. Unless we know what it is, what its plans and objectives are, too frequently the tendency is to overlook the balanced well-rounded army it aims to provide. Let us review the situation for the Army of the United States as it stands in the year 1937.

Needless to say, these remarks have no bearing whatever upon the *use* of our military power—a function of statecraft. It is safe to say, however, that in essence this function ever has been guided by the injunction of our first President that we should maintain ourselves in a "respectably defensive posture." This is a natural postulate of his dicta: "To be prepared for war is one of the most effective ways of preserving peace. A free people ought not only to be armed but disciplined, to which end a uniform and well-digested plan is requisite." From such a beginning, through succeeding generations until the good-neighbor policy of today, the use of our military power as a function of statecraft always has been and is today to keep it in a "respectably defensive posture." Considering some facts and figures of the moment we get the best measure of our ability to maintain that posture.

CONSIDER first our military air power because it is of first concern. By 1942 the Army's objective is to have 2358 airplanes of which 2187 will be for the Regular Army and Organized Reserves and 171 for the National Guard. To meet this program in its entirety, 2092 Regular officers and 1304 Reserve officers will be required. This is based on a thorough study of the defensive situation of the United States and its foreign possessions. It takes into consideration agreements as to the joint and separate rôles of the Army and Navy. The number of squadrons of various types of combat planes to execute these missions has been determined, as also have the training needs in plant, airplanes, and instructor personnel necessary to equip and maintain these squadrons. By the end of the next fiscal year it is estimated that there will be 1479 project and 83 nonproject airplanes in service. By the end of the following year (1939) these numbers will have increased to 1963 and 120, respectively.

To meet the 1938 figure, corresponding increases of Regular and Reserve officers and enlisted men will be necessary. Ten enlisted men are required to man, serve, and supply an airplane in the Army. All told, at the end of the fiscal year 1942, 2092 Regular officers, 1304 Reserve on active duty, and 23,615 enlisted men—including flying cadets—will be required to man our 2358 airplanes and 6 balloons. Despite the fact that on July 1, 1926, an act was passed to provide more effectively for the national defense by increasing the efficiency of the Air Corps of the Army, and despite the fact that the Secretary of War was authorized to equip and maintain 1800 serviceable airplanes, this program, calculated to be completed within five years, never has been met. Today, after nearly ten years, the Army Air Corps finds itself no better off in the number of airplanes on hand than it was when the 5-year program was inaugurated, except that the airplanes now being delivered are much more effective than the old models.

The status from year to year during this period is interesting. Considering aircraft on hand and on order the figures are as follows: in 1931 there were 1810; 1932, 1716; 1933, 1775; 1934, 1364; 1935, 1441; 1936, 1414; 1937, 1644; 1938 (estimated) 1971. These deficiencies have seriously handicapped the effectiveness of the GHQ Air Force. This organization was organized to make further and more comprehensive use of the existing principles of surprise, concentration of effort, and extreme mobility. It was not formed to establish new basic principles of war. Its quota has been set at approximately 947 combat airplanes. It has today slightly more than one third of that number.

Closely related to the status of our newest military arm is the condition of rearmament and reëquipment generally. The Army is still at work on the completion of the mechanization of the Cavalry Brigade and the 1st Cavalry Division. There is now nearing completion the equipment with tanks of the light-tank regiment and seven of the eight light-tank companies for use with infantry divisions. This still will leave more than one hundred vehicles required for the equipment of the medium-tank regiment. Our other armament advances are somewhat piecemeal. The Army is at work on modern gun carriages for 75-mm. batteries and hopes within the next year to have equipped twenty-eight of the forty-five batteries of this caliber in the United States. Likewise it is engaged in the equipment of four batteries of 75-mm. wheeled howitzers which will complete thirteen of the eighteen batteries assigned to cavalry divisions of the Regular Army. Four antiaircraft regiments are to be motorized eventually; work soon will be in progress on the equipment of the third of these. In addition to the armament required for the aircraft to be procured, a limited number of 81-mm. mortars and modernized automatic rifles are being produced for the Regular Army. The National Guard is being equipped with machine guns for cavalry units, radio and wire equipment for combat troops, and guns and directors for antiaircraft regiments. Our military policy also includes the constant upbuilding of our war reserves, particularly of airplane bombs, caliber .50 ammunition, and gas masks.

Probably the best all-around picture of the use of our military expenditures for the coming fiscal year is given by a functional distribution of the total sum. Forty-six per cent of it represents pay of all military components. Four per cent is for civilian personnel, 3 per cent for clothing of the Regular Army and National Guard, 8 per cent for subsistence and forage, 15 per cent for the maintenance and operation of all types of plant and equipment, including armament, motors and airplanes; 4 per cent for training, including schools, target practice, R.O.T.C., C.M.T.C. and National Matches. Two per cent will be for many miscellaneous items, such as research and development, procurement planning, and claims; 16 per cent for new equipment of all types, and 2 per cent for new construction. Thus it will be seen that 61 per cent of our military expenditures is not for "arms," as the newspapers have a habit of saying, but for pay, clothing and subsistence; 21 per cent is for plant

operation and maintenance and only 18 per cent for new equipment and new construction.

OUR defense policy from the standpoint of personnel sounds Lilliputian when compared to the standing armies of other great states. For some years the War Department has advocated a minimum of 14,000 officers and 165,000 men in the Regular establishment. These minimum needs, however, will be subject to increase chiefly to meet Air Corps requirements. For the civilian components, the objective is 210,000 officers and men for the National Guard and 120,000 Reserve officers. The Department hopes some day to initiate steps toward the establishment of an elisted reserve of 150,000 men. Morale of both officers and enlisted men is most satisfactory, although housing conditions in the Army are still not what they should be. During the past year, grades and ratings of enlisted men to meet the problems arising from the initiation of modern equipment programs for airplanes, mechanization, and motorization, have been made more flexible and permit of advancement of worthy noncommissioned officers and skilled technicians. The new system of promotion for the Air Corps has brought younger officers to rank commensurate with their responsibility, and field training for large units has been provided generally. The GHQ Air Force has carried out exercises to determine its ability to meet the demands of varying conditions in various parts of the country. Infantry brigades have been concentrated for training and the overseas garrisons have conducted their customary maneuvers.

Looked at as a whole it can be said that the most serious deficiencies of our military organization are those of matériel. The most serious of these are items of an exclusively military character not susceptible of replacement by commercial substitutes or improvisations when they are needed. Antiaircraft matériel in particular is far short of minimum requirements.

EVEN a cursory examination such as this, indicates the urgency of a *rapprochement* simply on the basis of dollars and cents. Our military activities cost almost half a billion dollars—not by any means an extravagant sum and certainly not a war-provoking expenditure. As a people, we still spend more than that annually on cosmetics and three times as much for cigars and cigarettes. But comparisons of expenditures these days do not mean much. More to the point is the eventual necessity of spending less to keep within national income and also of spending proportionately more for matériel than now is being done. There is abundant truth in the following paragraphs from the report of the House Committe on Appropriations on the expenditures of the military establishment for the current fiscal year:

"Eliminating the Air Corps and the civilian components, the 16 per cent for new equipment becomes 4 per cent plus, and the committee wishes to stress that point with as much emphasis as possible. Unless there is to be an appreciably larger allocation to the military arm in future budgets, our defense preparation very largely will consist of man power, unequipped and unimplemented and virtually unprepared to offer resistance to any force equipped with modern offensive weapons and agencies. We are short of tanks, of armored cars, of semiautomatic rifles, of antiaircraft guns and accessory equipment, of ammunition, of motors, of guns equipped for high-speed towage, etc. Except much of the motor equipment, these are items, using the language of the Chief of Staff, 'of an exclusively military character, not susceptible of replacement by commercial substitutes or improvisations when they are needed.'

"The picture is one which challenges the policy of continually adding to the fiscal demands of personnel. We are practically at a standstill on housing. There is a draft of a bill in the Bureau of the Budget now for construction at military posts calling for a total outlay of $162,000,000. In addition to that, the committee is advised that construction at bases and stations under the Wilcox Act will cost approximately $115,000,000. The expanded Air Corps itself, expected to be realized by the end of the fiscal year 1940, apart from military personnel, is estimated to impose an additional annual demand of not less than $20,000,000 in excess of the $60,500,000 carried in this bill for the Air Corps.

"The committee feels that it should bring these matters to light. The situation is extremely disturbing, and unless funds are to be forthcoming without stint, it would seem that there has to be deferment of personnel expansion, and perhaps contraction. There would appear to be no other way to arrive at a balance as between personnel and matériel."

OUR current matériel needs are so urgent and so vastly important that we must soon face the fact that sixteen cents out of every dollar for national defense is disproportionate. We may again have to return to General Upton's equation for computing the strength of the Army. He laid down the broad rule that there should be one Regular soldier for every 100,000 of population. Possibly that will not work today in a world of increasing military strength. None the less, we had best face the issue squarely else we are but repeating the errors of the past.

Whether the Upton theory is right or wrong, our military policy must take into account the emphasis on machines in 1937 and make it more commensurate with the emphasis on men. Our general military policy is convincingly sound, but one cannot get away from the thought so well expressed by the Committee: "We are short of tanks, of armored cars, of semiautomatic rifles, of antiaircraft guns and accessory equipment, of ammunition, of motors, of guns equipped for high-speed towage . . . . the situation is extremely disturbing and unless funds are to be forthcoming without stint, it would seem that there has to be deferment of personnel expansion and perhaps contraction. There would seem to be no other way to arrive at a balance between personnel and matériel."

The renowned Baker Board report of three years ago, in its conception of national defense policy and military requirements therefor said: "There is a minimum below which such forces cannot be allowed to fall under any reasonable circumstances, if our requirements are to be met effectively. The composition of the overseas forces, ground and air, can be definitely determined as concrete local conditions are fixed. In the continental United States the possibilities of hostile invasion are such as to demand a combined ground and air force immediately available and characterized by great mobility and such striking power as to block, on any of our coasts and frontiers, a hostile attempt to invade. The strength and composition of these covering forces should be adequate to hold an invader while the citizen forces are being mobilized." And should we not add "while equipment is produced—because so much of it is not now in being"?

Association Affairs

MR. CARL L. BAUSCH APPOINTED ASSISTANT DISTRICT CHIEF

THE Chief of Ordnance of the Army announced recently the appointment of Mr. Carl L. Bausch as Assistant District Chief of the Rochester Ordnance District. Col. Ledyard Cogswell of Albany, N. Y., is Chief of the District, the headquarters of which are located in Rochester.

Mr. Bausch, vice-president and manager of research in engineering of the Bausch & Lomb Optical Company, is of the third generation of his family engaged in optical-instrument manufacture. He was graduated from Syracuse University in 1909 and in that year entered the employ of the company as a machinist. At the outbreak of the World War he became superintendent of the mechanical division and was responsible for equipping the plant to handle the production of range finders and other fire-control instruments which the company was called upon to manufacture. Following the war he was made chief engineer; in 1926 he became manager of research in engineering; in 1931 he was made a director of the company and in 1935 a vice-president.

Mr. Bausch is the inventor of many optical and optical-machining instruments. He is a frequent contributor to the technical press on the coördination of research engineering with production and sales in the optical industry and on diamonds as metal-cutting tools. Long a member of the Army Ordnance Association, he also is well known for his professional activities as a member of the American Society of Mechanical Engineers, the Optical Society of America, the American Society for the Advancement of Science, the National Research Council and the Advisory Council of the American Institute of Physics. In 1932, on the recommendation of Colonel Cogswell, Mr. Bausch was appointed to the Advisory Board of the Rochester Ordnance District.

We join with all friends of ordnance procurement planning in welcoming Mr. Bausch as Assistant District Chief. His broad engineering and manufacturing experience are of invaluable aid to industrial preparedness. The company of which he is vice-president is one of the few organizations equipped to produce optical instruments in the United States and during a long period has rendered valuable assistance to the Army and Navy in the development and production of their requirements. The ordnance cause is fortunate in having the coöperation of this organization and the Rochester Ordnance District is likewise fortunate in the service of a distinguished engineer and executive to assist Colonel Cogswell and the other officials of the district in their important peace-time service to the national defense.

BOSTON POST

LIEUT. COL. C. S. ROBINSON, Ord. Res., professor of mechanics at Massachusetts Institute of Technology, was elected president of the Boston Post, Army Ordnance Association, at the final meeting of the 1936-1937 season held at Watertown Arsenal, Watertown, Mass., on June 15th. A new vice-president, Mr. C. H. W. Cowdrey, and five directors also were elected.

The meeting was addressed by Col. C. T. Harris, Jr., Ord. Dept., who was then commanding officer at Watertown and who has since returned to his former assignment as Chief of the Planning Branch, Office of the Assistant Secretary of War.

Before the meeting, Post members witnessed a demonstration of one of the newest antiaircraft guns just completed at the arsenal. A crew of arsenal personnel very efficiently brought the gun into firing position where it created much interest, especially among the manufacturer-members of the Post.

Following the demonstration, the meeting was called to order at the Officers' Club by then President M. T. Carney and reports of officers and committees were received, after which the election of officers and directors was held. The following were named directors of the Boston Post: for two years, Messrs. Carney, A. E. Anderson, and C. E. Fuller; for one year, Messrs. W. Van Pattensteiger and R. E. Goho. All these directors and the officers mentioned above were elected unanimously. They, together with the following officers and directors who have one or more years to serve, make up the complete official roster of the Boston Post for the coming year: Directors T. L. Ames and R. J. Thanisch, Treasurer Archibald McMillan, and Secretary J. S. Crawford.

RETIREMENT OF LIEUT. COL. CHARLES R. BAXTER

LIEUT. COL. CHARLES R. BAXTER, former secretary of the Army Ordnance Association and editor of ARMY ORDNANCE, will be retired from active service in the Army on October 31st upon his own request. Having served more than thirty years as a commissioned officer, Colonel Baxter will terminate his active Army career to become an official of Kendall Mills, one of the country's largest textile manufacturing organizations. He will take up his new duties at Charlotte, N. C., after November 1st.

LIEUT. COL. CHARLES R. BAXTER

Colonel Baxter's many friends in the Army and in industry, while regretting his loss to the Ordnance Department, join in extending good wishes to him in his new field of activity. ARMY ORDNANCE bespeaks its gratitude for his leadership and energy during the period from 1926 to 1929 when he was secretary and editor. Throughout his military career he has filled many positions of responsibility and frequently was called upon to undertake assignments of an industrial and executive nature. This type of service began after the World War when to him was assigned the arduous task of conducting the operations of the Ordnance Salvage Board. These duties gave ample scope to the administrative ability he had shown in his military assignments. Later he had the extreme good fortune of serving as executive officer to Maj. Gen. C. C. Williams during a portion of the General's distinguished service as Chief of Ordnance. Subsequently Colonel Baxter was called upon to assist the National Recovery Administration during its earliest days of organization and operation.

Readers of this journal well know the fine work Colonel Baxter did for the Army Ordnance Association. Under his direction the organization grew in numbers and in importance. He expanded the field of influence of ARMY ORDNANCE during his editorship. It was during his tenure as executive secretary that the Association was incorporated under the laws of the District of Columbia, its constitution and by-laws revised, group membership inaugurated, and the financial status of the society improved considerably.

He was appointed to the United States Military Academy from Colorado and was graduated in the class of 1911. Commissioned a second lieutenant in the Coast Artillery he served at Fort Monroe, Fort Baker and Fort Kamehameha. In 1915 he was detailed to the Ordnance Department with the rank of

first lieutenant. He was stationed at Rock Island Arsenal from January 1916 to June 1918 where he was in charge of the equipment shops. During this period he also served as a member of the Wood Utilization Committee of the War Industries Board. The war-time manufacturing program at Rock Island made necessary additional proof facilities and to him fell the responsibility of building the Savanna Proving Ground at Savanna, Ill. In February 1919 he was transferred to the Office of the Chief of Ordnance and placed in charge of the Construction and Facilities Branch of the Field Service, and for a time served as chairman of the Ordnance Salvage Board. In 1926 he was graduated from Harvard University with the degree of master in business administration. He then returned to the Office of the Chief of Ordnance as fiscal officer and executive assistant to General Williams. It was during this tour of duty that Colonel Baxter occupied the editoral desk of ARMY ORDNANCE and the secretaryship of the Association. Noted for his ability as an efficient director of manufacturing operations he was assigned to the Frankford Arsenal, Philadelphia, Pa., in July 1930, where he was placed in charge of the Instrument Department and later of the Artillery Ammunition Department and the War Plans Section. Following his service with the National Recovery Administration he was assigned to the Springfield Armory, Springfield, Mass., and as assistant to the commanding officer assumed charge of manufacturing operations there.

The retirement of Colonel Baxter from active service in the Ordnance Department removes from daily contact with its plans and problems an officer of the highest attainments. His many friends wish for him in civilian life that same success which has characterized his military career, and ARMY ORDNANCE extends to its former editor the felicitations reserved for those to whom it is deeply grateful.

Membership Activities

SUGGESTIONS have been made by members of the Association throughout the country for intensified effort toward building up the Association's membership. With these, of course, we are in hearty accord and offer the following suggestions which may be of special promise during the fall and winter season of 1937-1938.

Our thirteen local posts throughout the country offer a convenient medium not only for the interchange of ideas and professional advancement among members but especially for gaining the interest and support of hundreds of our fellow citizens who should be—but who are not—identified with the ordnance movement. Our local chapters offer a forum where subjects of technical concern are deliberated, where the principles of industrial preparedness are expounded and where discussion leads to more general understanding and agreement as to the broader questions involved. Hence to these local organizations which have in the past rendered such constant support to the Association's objective, the hope is expressed that programs of exceptional interest can be arranged during the coming season. Some members and officials of local posts are considering the advisability of inaugurating monthly or bimonthly luncheon meetings.

In addition to this, we look forward to a season of evening meetings where our members and their friends can gather for the important discussions which befit the times. Never before in the eighteen years of the Army Ordnance Association's existence have there been so many problems bearing upon military affairs on which our members should be informed. Gratefully can we acknowledge that the Army and Navy of the United States are today vastly improved organizations over their counterparts of a decade ago. But with the improvement have come responsibilities, particularly in the field of industrial preparedness. Its problems and processes are now more important than ever before. For these reasons, our meetings through the fall and winter of the coming year will provide individual enlightenment under auspices where military and industrial leadership stand forth in their proper light.

The membership is again urged to exert its effort toward interesting other fellow citizens in the aims and purposes of the ordnance cause. In this way the strength of the organization can be raised above its former levels.

Army Ordnance Association Scholarship Keys

AT Georgia School of Technology, the Association's keys for ordnance scholarship were awarded to Cadet Capt. W. C. Norton, senior class and to Cadet 1st Sergt. J. T. Mundy, junior class. This year, due to the number of close averages in military studies, the keys were awarded on the basis of combined military and academic standing. Mr. Norton, of Meridian, Miss., obtained an average of 4.13 out of a possible 5 during his five years of college work. Adjutant of the 1st Section, Co-Op Ordnance and Signal Battalion, he was graduated with a degree of bachelor of science in mechanical engineering. Mr. Mundy, of Atlanta, Ga., a student of mechanical engineering, had the highest grade in military and academic subjects in the junior class. He was 1st sergeant of Company K, Co-Op Ordnance and Signal Battalion. This company, commanded by Cadet Capt. R. M. Mendez, Ordnance student, won the competitive drill for the best-drilled company among the Coast Artillery, Infantry, and Naval Units. Capt. Edward C. Franklin, Ord. Dept., is in charge of the Ordnance Unit, R.O.T.C., at Georgia Tech.

At Massachusetts Institute of Technology, the scholarship keys were awarded to Mr. Norman A. Birch, senior class, and to Mr. Oliver J. Kangas, junior class, both of the Ordnance Unit of the Advanced R.O.T.C. The awards were made during the Regimental Review, held on May 19th. Maj. Harold A. Nisley, Ord. Dept., is in charge of the Ordnance Unit at M.I.T.

At Cornell University, President Livingston Farrand presented the two scholarship keys at a review in his honor held on June 2nd. Recipients of the awards were Mr. Lloyd G. Mount, of Central Square, N. Y., and Mr. William G. Stolberg, of Glen Ridge, N. J.—both second-year advanced Ordnance students graduating from Cornell this year. Mr. Mount, who received his degree in chemistry, will be at Yale next year on a research fellowship. Mr. Stolberg received his degree in mechanical engineering. Capt. Merle H. Davis, Ord. Dept., is in charge of the Ordnance Unit at Cornell.

New Members

THE following have been admitted to membership in the Army Ordnance Association: S. S. Adams, St. Louis, Mo.; H. M. Aring, Washington, D. C.; Sheridan K. Barringer, Kannapolis, N. C.; Palmer Bescherer, York, Pa.; Leland A. Bristol, Fort Mills, P. I.; Lewis H. Brown, New York, N. Y.; Joseph A. Burnes, Denver, Colo.; L. M. Cassidy, New York, N. Y.; Jerome B. Corby, Ladue Village, Mo.; A. Cromwell, Lompoc, Calif.; Carl R. Dutton, Ann Arbor, Mich.; A. R. Fisher, Manville, N. J.; George A. Fritz, San Francisco, Calif.; E. R. Galvin, Peoria, Ill.; William M. Galvin, Chevy Chase, Md.; C. C. Hetlage, St. Louis, Mo.; L. R. Hoff, New York, N. Y.; Lester M. Buettig, Stepney, Conn.; B. F. Jones, 3rd, Pittsburgh, Pa.; H. W. Kolpack, Fort George G. Meade, Md.; J. P. Kottcamp, Waukegan, Ill.; Reid McCrum, University City, Mo.; Jack McPhee, Los Angeles, Calif.; Clarence A. Michael, Pedricktown, N. J.; Howard F. Moeck, Wheeler Field, T. H.; Glenn F. Mustee, Rio Tinto, Nev.; Fred C. Ness, Arlington, Va.; J. A. O'Brien, New York, N. Y.; R. M. Price, Springfield. Mass.; Louis P. Ray, Watertown, Mass.; Paul J. Roberts, Inglewood, Calif.; Frank G. Ruggles, Jamaica, N. Y.; R. C. Simmons, New York, N. Y.; Harry C. Snell, Whittier, Calif.; Edwin F. Wallace, Honolulu, T. H.; Ralph R. West, Cleveland, Ohio; Seth Wiard, Washington, D. C.; Charles H. Yust, Jr., Philadelphia, Pa.; and John A. Zublin, Los Angeles, Calif.

Professional Notes

MEETING OF THE S.A.E. ORDNANCE ADVISORY COMMITTEE

THE twenty-eighth meeting of the Ordnance Advisory Committee, Society of Automotive Engineers, was held at Peoria and Rock Island Arsenal, Ill., on June 7-8, 1937. The success of the Peoria session was due to the excellent program arranged by Mr. B. C. Heacock, president of the Caterpillar Tractor Company, which included provision for members to indulge in their favorite sports on Sunday afternoon. The morning and a good part of the evening of the first day of the meeting were devoted to purely technical matters, as indicated in the agenda for that phase of the meeting. During the afternoon, the committee had the advantage of a highly interesting tour of the Caterpillar plant where it was introduced to modern production of Diesel and gasoline engines, as well as the entire Caterpillar line of commercial tractors.

The following morning the party proceeded to Rock Island Arsenal. After a fine luncheon, the group was conducted through that part of the arsenal devoted to automotive work, including observation of production combat vehicles undergoing both development and shop-acceptance tests. Members who desired to ride in these vehicles were invited to do so—practically all accepted. Considerable discussion relating to purely technical problems was had with the arsenal personnel. Most favorable comments were expressed upon production methods and quality of product found at the arsenal.

The developments of Ordnance automotive vehicles and of special features of them, and the results of their proving-ground and service tests, were explained to the committee. Likewise, the industrial representatives outlined their developments to meet industrial requirements under conditions approximating service conditions. Discussions brought out details which are important to the Ordnance Department's program.

The committee gave its opinion and recommendations for the current program which will be helpful in taking advantage of important industrial developments now in progress. The opinion was universal that the Department's automotive-development program is underfinanced and that its magnitude and importance warrant a much more liberal use of funds. The Department is gratified that its accomplishments, as exemplified by service and development vehicles, received generally favorable comment. Moreover, the fine coöperation of industry was illustrated both by attendance of Advisory Committee members and by their keen interest in the problems facing the Ordnance Department. This association with the leaders of industry, keeps the Department in touch with current developments.

Following are the Advisory Committee members and alternates who attended the meeting: Col. H. W. Alden, chairman of the committee and chairman of the board of directors, Timken-Detroit Axle Company, Detroit, Mich.; Col. W. G. Wall, vice-chairman of the committee and consulting engineer, Indianapolis, Ind.; Col. G. A. Green, vice-president in charge of engineering, General Motors Truck Corporation, Pontiac, Mich.; Col. E. F. Norelius, chief engineer, Tractor Division, Allis-Chalmers Manufacturing Company, Springfield, Ill.; Col. A. W. Herrington, president, Marmon-Herrington Company, Indianapolis, Ind.; Mr. G. A. Round, assistant chief, Engineering Division, Automotive Department, Socony Vacuum Oil Company, New York, N. Y.; Mr. A. J. Scaife, engineer, Auto Car Company, Ardmore, Pa.; Mr. J. E. Hale, manager, Development Department, Firestone Tire & Rubber Company, Akron, Ohio; Col. Paul Weeks, Engine Sales Division, the Caterpillar Tractor Company, Peoria, Ill.; Mr. A. W. Scarratt (alternate for Mr. E. A. Johnston), in charge of engineering, International Harvester Company, Chicago, Ill.; Mr. H. T. McDonald (alternate for Colonel Weeks), engineer, Caterpillar Tractor Company, Peoria, Ill.

Mr. John A. C. Warner, general manager, S.A.E. and Mr. H. H. Howard of the Caterpillar Tractor Company, also were present. The keen interest of the S.A.E. in the work of this committee was evidenced by Mr. Warner's presence at this meeting.

The personnel of the Ordnance Department who met with the committee and participated in its deliberations was: Col. C. M. Wesson, Col. G. F. Jenks, Col. R. W. Case, Col. B. O. Lewis, Maj. J. K. Christmas, Capt. J. E. B. McInerney, Capt. E. L. Cummings, H. A. Knox, and W. F. Beasley.

AIR FORCE DEMONSTRATION FOR WAR COLLEGE

UNITS of the Second Wing of the GHQ Air Force, commanded by Brig. Gen. Gerald C. Brant, presented a most impressive demonstration of the fire power of modern aircraft for the benefit of the entire student body of the Army War College on June 15, 1937, at Langley Field, Va.

The program included the dropping of twenty 100-pound demolition bombs, four 300-pound demolition bombs, two 600-pound demolition bombs, two 1100-pound demolition bombs, and two 2000-pound demolition bombs. All bombs were equipped with instantaneous fuzes and were dropped at 12,000-feet altitude from the new B-17 (Flying Fortress) airplane, by units of the 2nd Bombardment Group.

Mass firing on water and ground targets by the 8th Pursuit Group and an attack upon water and ground targets using machine guns and fragmentation bombs by the 37th Attack Squadron completed the demonstration. Members of the class were much impressed by the dispatch with which the demonstration was carried out and with the fire power exhibited.

Langley Field, named in honor of one of aviation's pioneers, Dr. S. P. Langley, and now designated as the First Air Base, is one of the oldest and largest Air Corps stations in the country. It is located 4½ miles northeast of Hampton, Va., and comprises an area of approximately 1850 acres.

Acquired in 1916 by Congress, Langley Field has gone through a long, slow process of development. Modern hangars, shops, barracks, and quarters have been built. At present, due to the rapid expansion which has taken place in the last few years, these facilities are taxed to the limit.

The General Headquarters Air Force was organized with its headquarters at this station in March, 1935. At present there are approximately 2000 troops and 200 officers stationed at this base on duty with the following organizations:

Headquarters and Headquarters Squadron, GHQ Air Force; Headquarters and Headquarters Squadron, 2nd Wing, GHQ Air Force; Headquarters and First Air Base Squadron.

Second Bombardment Group consisting of: Headquarters Squadron, 20th Bombardment Squadron (less 1 flight), 49th Bombardment Squadron (less 1 flight), 96th Bombardment Squadron (less 1 flight), 21st Reconnaissance Squadron.

Eighth Pursuit Group consisting of: Headquarters Squadron, 33rd Pursuit Squadron (less 2 flights), 35th Pursuit Squadron (less 2 flights), 36th Pursuit Squadron (less 2 flights), 37th Attack Squadron (less 2 flights).

Second Photo Section; Third Observation Squadron; also detachments of the Quartermaster, Signal Corps, Ordnance and Medical Departments.

Also at Langley Field is located the National Advisory Committee for Aëronautics. Extensive laboratories and wind tunnels have been built for coördinating by this committee the research needs of aëronautics and the conduct of investigations, the results of which are made available to the Army, Navy, Depart-

ment of Commerce, and the aircraft industry. Research conducted by this committee has led to material improvement in the performance, efficiency, and safety of aircraft. Thousands of dollars are saved annually at these laboratories through research and through the testing of scale models of aircraft prior to their being placed in production by the manufacturer.

"Little Aberdeen"

By G. B. Jarrett, *Lieut., Ord. Res.*

On A peaceful dairy farm in southern New Jersey the fourth annual Field Day of the Jarrett Museum of World War History was held, May 8, 1937. This year the faculty of the Bordentown Military Institute, of Bordentown, N. J., joined with the writer in making the affair one of outstanding interest. Over 700 spectators witnessed the exhibition which was held on the Workman Dairy Farm, Moorestown, N. J.

As a collector of curios, I long had toyed with the dream of some day having both the material and a suitable space to imitate the Ordnance shows held at the Aberdeen Proving Ground, if only on a tiny scale.

This year, when the B. M. I. faculty and I planned the field day, our first thought was to provide interest and instruction for the cadets; secondly, to show off their military training; and lastly to give the visitors an opportunity of seeing for the first time the entire set-up of the museum.

Regarding this museum, let me say that a "den" collection is one thing, but when one starts shipping home artillery, war planes, automotive pieces, etc., it is another. A serious housing problem soon presents itself. For years I have been cramped for space, and only in the past twelve months have I moved the entire museum—little by little—to one address—the farm at Moorestown where the museum section is known as Artillery Park—an 88-acre farm. Believe it or not, but it takes two acres to store the museum and five to display it!

The farm offers great possibilities to a museum planned as this one is, because realistic settings for large exhibits are easily obtained, and the best feature of all is that maneuvers can be held and certain types of firings or demonstrations attempted with safety.

The study offered by the exhibits is ideal for the military student, and for a long time I have wanted such students, as well as interested visitors and friends, to have the privilege of seeing the museum. With this end in view, plans were made with the faculty of B. M. I. who coöperated in fine style.

It required about six months' work to rearrange the museum so as to be practical and interesting. Some small buildings have been erected to house temporarily the more perishable exhibits. The artillery, trucks, etc., are jacked off the ground in more or less permanent positions and are kept painted.

The valuable war planes are a problem and have not yet been housed permanently. These are rigged for special occasions and then knocked down again for storage. Eventually, hangars will permit their storage rigged as for flying; this is important if they are to be of any use as exhibits.

With the museum prepared for the big day, the actual program was our main consideration—to say nothing of our hopes for the weather. Through the efforts of Maj. Walter D. McCord, P. M. S. & T., a fine program was prepared. Two New Jersey National Guard planes, under Maj. B. L. Copsy, were to be on hand and the C. W. S., under Col. Jos. D. Sears, was to lay a smoke screen during the sham battle. Certain distinguished guests were invited. Music was to be furnished by the B. M. I. Cadet Band, the Atlantic City Caledonian Band composed of Scotch war veterans, and the Bordentown Bugle and Drum Corps. The museum was to display its exhibits and provide a lecture, to be followed by the demonstration of several museum pieces. The Institute prepared to serve a luncheon cooked on the museum's relic field kitchens and served in mess tents loaned by Camp Dix. A public-address unit was engaged for the day, and it aided greatly in keeping the visitors informed of the various phases of the program.

With all arrangements completed, May 8th dawned—cloudy at that! Gov. Harold G. Hoffman arrived at noon and was welcomed by the Cadet Band, his car passing through a double lane of cadets 600 yards long. A few minutes afterward the Caledonians came swinging down the road with their pipes giving off a ringing Scottish air.

The cadets had arrived earlier, and their sizeable pup-tent encampment, together with the mess tents at one end of the field formed another feature of the general military show. This part alone took up about two acres.

By 1 P.M. the lecture got under way and closed with a firing program. First, a British 3-inch Stokes mortar was fired, followed by a French 58-mm. mortar. This latter was of interest as the projectile is odd-shaped and produces a queer sight traveling through the air. Then one round was fired from a British 75-mm. Vickers mountain howitzer.

Turning the "mike" over to Major McCord, the Institute's part of the program was started. Comdr. C. J. MacGregor, U.S.N. Res., and Mr. Murray Weiner were presented with an American flag and a B. M. I. pennant to place at the North Pole on their expedition there during this year.

The Caledonian Band gave a concert and drill followed by short addresses by Governor Hoffman, Gen. Clifford Powell, N.J.N.G., Commander MacGregor and others.

The sham battle now began in earnest with Major McCord giving a "play by play" account over the address system as the cadets attacked over a 40-acre field. At the upper end of the field four "enemy" machine-gun nests blazed away in a realistic manner. The National Guard planes were supposed to be in support of the offensive action but due to their being grounded at Newark by fog that morning, a spectacular part of the program was missing. However the visitors did not seem to miss the planes. The defense put out a smoke screen in front of their guns through which the attacking cadets passed to reach the objective. This closed the program, save for a short bit of stunt flying by Bill James of Wildwood, N. J., in a Waco. He had been at the farm all day and was not hampered by the fog that held up the other planes. The entire military show had lasted from 9 A. M. until 5 P. M.

The museum has, after some twenty-two years of collecting, reached more or less elaborate proportions. The Italian Government, during the past two years, has donated some very valuable sets of equipment, together with a complete library of twenty-one volumes on its activities during the World War, an album of photographs, and a hand-carved reading desk. The British War Office furnished several valued books for the research library, which has reached large proportions of late. The Crown Prince of Germany presented one of his caps worn at Verdun, and Col. Armand Pinsard of the French Flying Corps presented a cap that he used during the war. Numerous other personal bits in the museum add a human-interest touch to otherwise commonplace but valuable curios.

The machine-gun section of the museum is worth passing mention, as it contains sixty-five specimens. I have, perhaps, been especially interested in these guns, and a discussion of them is a story all by itself. Light and heavy ground types, tank, aircraft and antiaircraft types form the group, with but two or three patterns missing from all such designs made up to 1919.

Outstanding relics usually too big for the average collector found a warm spot in my heart. Such classes include the artillery pieces (mainly German), assorted caissons and limbers, transportation column vehicles (horse and automotive), hospital trucks and ambulances, machine-gun carts (with the German unit about the rarest piece in the whole museum), the trench mortars, and lastly, the fleet of war-time planes. The entire collection weighs in excess of 65 tons and the specimens, including the many diversified types, number more than 7600 pieces.

Ordnance In Review

NOMENCLATURE OF ANCIENT ARTILLERY, PART I

BY LIEUT. COL. CALVIN GODDARD, *Ord. Res.*

THE following compilation of names and brief descriptions of obsolete pieces of ordnance makes no pretense at being all-inclusive. Each of the terms defined below was culled from my own arms library, the resources of which were far from exhausted when it was apparent that more material than could be set forth conveniently within the columns of "Ordnance In Review" already had been accumulated. Obviously, had the search been more comprehensive, numerous additions to the list would have been forthcoming.

With rare exceptions, all cannon of experimental types, all those named for their inventors, all pieces of which but a single specimen was fabricated, all not employing some form of powder as a propellant, and all designed for ammunition of small-arm caliber, purposely have been omitted. Each of these groups is sufficiently large to merit individual discussion, and to each I hope to devote, at some future date, the space it properly deserves.

Among the volumes consulted in the preparation of the material which follows, were:

Buchsen Schiesseren Künst, by Friederich von Sedlitz: Frankfurt, 1676.

Traité des Armes, by Louis de Gaya: 1678 (Oxford reprint, 1911).

Neues Kriegs-Ingenieur-Artillerie-See- und Ritter Lexicon, by Jacob von Eggers: Dresden, 1757.

Kleines Handbuch für neu angehende Buchsenmeister und Feuerwerker, by Johann Baptist Veit Koch: Bamburg, 1770.

Military Antiquities Respecting a History of the British Army, by Francis Grose: London, 1801.

The Bombardier and Pocket Gunner, by Capt. Ralph W. Adye: London, 1803.

Military Dictionary, by William Duane: Philadelphia, 1810.

Manuel historique de la technologie des armes à feu, by Meyer-Rieffel: Paris, 1837.

Wilhelm's Military Dictionary and Gazeteer: Philadelphia, 1881.

Farrow's Military Encyclopedia: New York, 1885.

Die Kriegswaffen, by August Demmin: Leipzig, 1893.

The Gun and Its Development, by W. W. Greener: ninth edition, London, 1910.

Beiträge zur Geschichte der Feuerwaffen am Niederrheine, by Karl Jacobs: Bonn, 1910.

A Dictionary of Military Terms, by E. S. Farrow: New York, 1918.

Das Aufkommen der Pulverwaffe, by Bernhard Rathgen: Munich, 1925.

A Glossary of the Construction, Decoration, and Use of Arms and Armor, by G. C. Stone: Portland, Maine, 1934.

Modern Military Dictionary, by Col. Max B. Garber: Washington, D. C., 1936.

The Gun Founders of England, by Charles ffoulkes: Cambridge, 1937.

A study of the texts just enumerated reveals consistent borrowing by one author from another. This is only to be expected, but as a result, it is obvious that any errors committed by scribes long dead are likely to be repeated in works of later vintage. Again, descriptions of one and the same weapon will be noted to run through quite a scale of variations, according to the source quoted. This is probably due chiefly to the fact that any one type of weapon is susceptible, through the centuries, of very considerable modification in its specifications, its basic name remaining unchanged. Hence the definitions set forth below are offered with the admonition that they are elastic in the extreme, and in large measure open to modification or revision as additional reference sources become available. The list follows:

Amusette (Ammuzette): A small gun mounted as a cannon but fired as a musket. Invented by Marshal Saxe and much used during the French Revolution. The ammusettes current in 1793 were brass breechloaders of 5 to 7 feet in length, firing 8 oz. of powder and a ball or charge of buckshot weighing from 8 to 32 oz.

Aspic (Aspik, Aspitic): This was introduced in the fifteenth century as a 2-pounder, weighing 700 lbs. It later became a 12-pounder, 11 feet long, weighing 4250 lbs., range, 1800 paces.

Barce (Berche, Base): An ancient small gun, shorter and broader than the falconet.

Basilisk (Basiliske): Introduced in the fifteenth century as a 48-pounder weighing 8500 lbs., it was, in the time of James I, reduced in size to a 15-pounder of 5-inch bore, weighing 4000 lbs., with a 10-lb. powder charge.

Bastard (Batarde, Battard): Term formerly applied to any gun of unusual type or proportions. Specifically, an ancient cannon 9½ feet long, weighing 1950 lbs., and throwing an 8-lb. ball. Said to have been introduced by Jean Maurique de Lard, Master General of Ordnance under Charles V of France, in 1535.

Bastard Cannon: Introduced in the fifteenth century as a 36-pounder weighing 7900 lbs., it became, in the time of James I, a 41-pounder of 7-inch bore, but reduced in weight (4500 lbs.). The powder charge was then 20 lbs.

Bilboquet: A small 8-inch mortar with bore but ½-caliber long, throwing a 60-lb. shell a distance of 800 yards.

Bombard (Bombarde): Previous to the fifteenth century this was a term applied to all cannon (derived from the Greek "bombos"). Later it designated a small mortar fixed at the end of a firelock, and used for discharging grenades. To absorb recoil, it was rested on a halberd designed for the purpose. Invented by General Siebach about 1710. Other definitions are: "An Italian light cannon, *circa* 1500." "An ancient piece of ordnance, short, thick, and of large bore." Some used in the fifteenth century fired stones weighing 200-500 lbs.

Bombardello (Bombardelle): A small bombarde or hand cannon.

Brise-Mur (Fr.): A heavy piece of ordnance employed during the fifteenth century to batter down walls.

Buchsen (Ger.): Early designation in Germany for firearms of all kinds, great and small (means "Fireboxes").

Byssa: Ancient stone-throwing cannon.

Cannon: Any piece requiring more than one man to operate (not including machine guns), or firing balls. Under James I, a "cannon" meant a gun of 8-inch bore, weighing 6000 lbs., firing a 60-lb. shot with a powder charge of 27 lbs. Under Francis I of France (1551), it referred to a piece weighing 5300 lbs., carrying a 33¼-lb. shot. It was 9 feet, 10 inches long, and was drawn by 21 horses.

Cannon-perer (Cannon-perrier, Cannon-petro, Cannon-pedro): Early pieces of ordnance for throwing stone shot. Specifically, a gun of 6-inch cal. firing a 26-lb. (?) shot; under James I, a 6-inch weapon of 4000 lbs., firing a 24½-lb. (?) shot with a powder charge of 14 lbs.

Cannon Royal (Carthoun, Carthoum, Karthaune): In the fifteenth century this was a 48-pounder of 9000 lbs. Under James I it had an 8½-inch bore, weighed 8000 lbs., and fired a 66-lb. shot with a powder charge of 30 lbs. It was 12 feet long and had an extreme range of 2000 paces. Another author defines it as a sixteenth-century gun of 8.54-inch caliber firing a 74-lb. shot a distance of 1850 paces.

(The remainder of Colonel Goddard's glossary of obsolete ordnance terms and descriptions will be published in the "Ordnance in Review" department in the November-December issue.—ED.)

Communications

THE EDITOR:

I know that it must be apparent to you and to the Regular officers in Washington that an Ordnance Reserve officer who is engaged regularly in a private occupation, especially an older officer of higher rank who is daily fully occupied in a responsible business position, finds it difficult to take the courses mapped out by the Training Section.

One difficulty is that an executive cannot feel assured that he can work on a correspondence course regularly and thus hesitates to sign up for one. Another is that these courses usually contain so much elementary material which the older man knows instinctively that he grows impatient of them and will not take the time to write out the obvious material.

As a consequence of all this the Reserve officer in the higher executive position often has a seemingly bad record against him as regards study credits, whereas the real truth is that this same officer may actually read more material and more pertinent material than the young man whose Training Section record shows plenty of credits for routine courses of study.

Why not, then, have the Training Section allow certain study credits for the reading of the articles in ARMY ORDNANCE? This is logical, because the material in ARMY ORDNANCE is certainly carefully selected from the best and most apt of a great mass of available material. It is varied, and it is pertinent, logically arranged, and digested.

Take the specific case of the May-June issue of ARMY ORDNANCE. Would anyone deny that if an officer read "The Abyssinian War," "Four Decades of Mechanization," "The English Recruiting Problem," and "Standards for Army Supplies," he would not get more pertinent knowledge than if he had taken the ordinary type of elementary correspondence course?

Why, then, should not the Training Section approve a form of schedule upon which the officer could note the articles he has read in ARMY ORDNANCE, and possibly the Army books he has read, and then assign credit for this reading?

GEORGE S. BRADY,
Washington. *Lieut. Col., Ord. Res.*

Why not?—ED.

THE EDITOR:

I have just received my copy of the July-August issue of ARMY ORDNANCE. As usual, I find much of a technical military nature of great interest; I would compliment particularly the Association on its very full treatment of ordnance questions and the problem of military procurement.

At this moment, however, what sticks in my crop is your short editorial (p. 35), "Antiaircraft in Spain." It just so happens that I have been getting all steamed up as to why ARMY ORDNANCE, after one solid year of this Spanish business, has not yet offered one fairly comprehensive and illuminating military analysis of the Peninsular conflict. Granted that everybody is shouting and howling about the political significance of this war, on the question of its military lessons there seems to be little difference of opinion among the experts.

Your editorial suggests that it is about time some of these experts got busy with the increasing loads of material available and said something. Why wait for the cessation of "propaganda in the news from Spain"? (When, in war time, does propaganda cease?) There are plenty of guns, tanks, bombs, aircraft, and armies in action. What are they doing, and how, and with what degree of success or failure?

One question in particular I would like to put to Liddell Hart, Major General Fuller or the English scientist J. B. S. Haldane: "Why has poison gas not been used thus far in Spain?" The Italians got around to it in Ethiopia; what is stopping the combatants beyond the Pyrenees? Is there a valid tactical answer to this question, and if so, what might it be? If the answer is "moral" or "political," or what have you, that would be an interesting admission, to say the least. Spain is a testing ground at present for just about every type of ordnance known: it is reasonable to suppose that these tests bear very directly upon our own problems of national defense, here and now. So why not spill something?

New York, N. Y. HAROLD WARD.

No luck yet. We hope soon to publish the facts.—ED.

THE EDITOR:

It seems to us that the key to the solution of Mr. Belloc's "The English Recruiting Problem" in the May-June issue of ARMY ORDNANCE already has been published. To our minds, the answer lies in the works of two Englishmen: the first, a writer who seems to have understood the English soldier better than any other; the second, a military authority—Rudyard Kipling and Liddell Hart. We would suggest that any person interested in the English recruiting problem would not waste his time in re-reading Kipling's "Army of a Dream" in "Traffics and Discoveries." The problem of recruiting is one to be worked out in terms of psychology, and we think that no man ever understood the mind of service men better than Kipling did. In "Army of a Dream" he sketches a possible organization which would have no recruiting problems save that of selecting the best of the applicants.

The psychological scheme is thoroughly sound. It involves a reorganization which probably will be necessary in any case. Changes in wages and living conditions of the men will not transform the habits of thought of an entire people. Changes in organization, work, and nomenclature might accomplish this result, strange though it seems.

The other half of the key lies in Liddell Hart's "Future of Infantry" in the chapter on "The Revival of Infantry." Here we find the army divided into two sections, called by Belloc the Regulars and the Reserve, but by Liddell Hart the Heavy and Light Infantry. The Light Infantry are the Regulars and are the only part maintained intact in peace time. But it is to be a new infantry—each man to be "stalker, athlete, and marksman," splendidly equipped and expert in his work. The men are more closely related to combat aviators. There is no recruiting problem here.

We do not mean to imply that one can take the psychology of Kipling's army bodily from the book, graft it to Liddell Hart's infantry and put it to work immediately. Neither was Verne's "Nautilus" a modern submarine. But the idea is there, and we think it adequate. We are positive that no person can read Belloc's article, "Army of a Dream," and "The Revival of Infantry" without seeing why we believe that a solution exists in them. As collateral reading on the Regulars we would suggest Hesketh-Pritchard's "Sniping in France" and on the Reserve, Johnson's article, "Training the Reserve," in the May-June issue of ARMY ORDNANCE.

We realize, no one better, that for a couple of Americans to suggest a work of fiction as the key to such a serious problem is, at the very least, cheek. But there it is, and it looks that way to us!

KELLY YEATON
Bremerton, Wash. S. S. YEATON

No suggestion could be based upon three greater experts.—ED.

Ordnance Field Service

FIELD SERVICE PROBLEMS, PART III

BY LIEUT. COL. RAYMOND MARSH, *Ord. Dept., U. S. Army**

This article was prepared prior to the recent issuance by the War Department of a tentative Infantry division organization, and was based on army organization as it then existed. The new organization, which was tested this summer, corrects many of the faults discussed in this article. After the results of the tests are made public, we hope to publish a series of articles covering Ordnance service in this new division. The 10th Ordnance Service Company has been organized, since this article was written, to provide Ordnance service for GHQ Air Force units. The organization of this company differs in many details from that herein proposed, but the general principles underlying its functions and operations remain unchanged.—EDITOR.

THE existing system of maintenance presents four defects: 1. There is no generally recognized and accepted line of demarcation between the maintenance functions of the troops and of the services, particularly with reference to automotive matériel. 2. There has been no increase in service personnel proportional to the increase in the quantity and variety of armament, and to the expansion of both motorization and mechanization. 3. The division of responsibility for the maintenance of automotive matériel between the Ordnance Department and the Quartermaster Corps is unsatisfactory and indefinite. 4. There is wide dissension in the Ordnance Department as to what are the maintenance functions and how they shall be accomplished. In the elimination of these four defects lies the Ordnance Field Service problem of maintenance.

It is recognized generally that in time of peace combat troops perform more maintenance and repair work than they ever would think of performing in time of war. This is logical, and in time of peace may be altogether desirable for a number of reasons. However, if in time of peace the creation of maintenance units in combat organizations, with their more or less elaborate equipment and personnel, is fostered or permitted, a system will be developed which inevitably will fall down in time of war. Certainly, the maintenance methods practiced in time of peace should conform to those to be followed in time of war.

A certain volume of maintenance work necessarily must be performed. It will be performed either by an appropriate service unit or by personnel from a combat unit diverted from their primary mission of combat. If the maintenance work is done by the combat unit, then either that unit will suffer a loss of its effective combat personnel because of their diversion of activities, or else the matériel will not be maintained properly. In either case, the combat unit is sure to suffer a loss of combat effectiveness because of either a decrease in personnel or a decrease in the quantity of serviceable combat matériel.

Back in 1921 and 1922, with respect to tank organizations the Adjutant General set up the principle that a combat unit should perform all maintenance and repair work on its automotive matériel that can be accomplished with the personnel, and the spare parts, and hand tools authorized for and issued to that unit. The same principle was followed by the Quartermaster Corps in their circular of 1933 which set up the present echelon system of maintenance. This circular limited the repairs to be undertaken by an organization to those which may be accomplished by the organization personnel with the assistance of the organization mechanic and his tools, and the organization's stock of spare parts. A similar line of demarcation should be set up with reference to all maintenance work.

An organization should be required and authorized to effect those repairs on its matériel which it can accomplish within the limits of time available with their own personnel and their own tools and spare parts which are authorized for and issued to that unit. The enunciation of such a policy would provide a flexible line of demarcation between these maintenance functions. It would give to small organizations, with their limited equipment, a small amount of maintenance work, whereas to larger organizations, with their more elaborate equipment, it would assign a larger share of maintenance work. It is not logical to assume that a military police company, let us say, with just a few motor vehicles and limited armament, should be expected or able to effect the same type of maintenance and repair work that a battalion of field artillery, with its hundred or more vehicles and its imposing and complicated array of armament, should and could effect.

This leads us to a consideration of the so-called echelon system of maintenance. The Army has come to accept rather generally the Quartermaster Corps' 5-echelon system. I am of the opinion that there should be but two echelons—one which will be performed by the troops, and the other which will be accomplished by the appropriate service. There is no reason why the troops themselves cannot distribute their maintenance work in as many phases or echelons as their military organization and tactical employment may permit or dictate. Similarly, there is no reason why a service should be required to accomplish its maintenance work in a specified number of phases or be under the necessity of setting up separate establishments for the performance of each of the so-called echelons.

AT the present time, War Department orders provide that with respect to automotive maintenance in war time or in emergency, either the Ordnance Department or the Quartermaster Corps will perform such third and fourth echelon maintenance as may be requested and facilities permit, without previous agreement or transfer of funds. This vague and indefinite division of responsibility is sure to lead to complications. It is but human for an organization commander to bring an unserviceable item to the nearest repair facility regardless as to what service may have supplied him with this item or to which service the repair facility may organically pertain.

This being the case, it is but inevitable that repair facilities will be faced with the problem of repairing all sorts and quantities of matériel located in the area surrounding their place of operations. Under such circumstances, an organization designed and equipped to effect repairs in a certain volume on a certain variety of matériel, will find itself faced with the task of effecting repairs in a much greater volume and on a greatly increased variety of matériel. One is forced to the conclusion that the result of this situation will be that a maintenance unit will be unable to perform satisfactorily either its originally contemplated mission or the task which it finds imposed upon it. Certainly a more definite division of responsibility for automotive maintenance between the Quartermaster Corps and the Ordnance Department is required.

When we come to consider the views held by individuals within the Ordnance Department, we find wide variations of strongly held opinions as to the functions of an Ordnance maintenance company, what equipment it should possess to discharge its functions, and how it should operate.

It is advocated seriously by some that an Ordnance maintenance company should consist essentially of mechanics mounted on motorcycles with side cars, and equipped with a tool kit containing little more than a cold chisel, a sledge hammer, a monkey

*This discussion presents the personal views of the author and does not represent official policy on the subject.

wrench, a screwdriver, a Stillson, and a pair of pliers. When one is ill and calls a doctor, it is expected that the doctor will be possessed of greater ability than the family member who renders first aid, and also that he will be equipped with supplies and instruments in excess of the contents of the family medicine chest. The same analogy holds good with respect to the abilities and equipment of an Ordnance maintenance company as compared with the Ordnance repair ability and maintenance equipment of a unit. Consequently, we should have Ordnance maintenance units capable of rendering Ordnance maintenance services in excess of the abilities of the several organizations of the using arms and services to service themselves.

Assuming that we have such companies, what shall be their functions? Shall they be limited to the issues of spare parts and replacement of components whose installation and adjustment require the skill of specially trained technicians, or shall they possess such machine tools, welding equipment, etc., as to permit them to effect mechanical repairs more elaborate than the mere replacement of components? The mere replacement of unserviceable parts, etc., rests upon the premise that the supply of spare parts remains adequate, uninterrupted, and as reliable as the rising of the sun.

In my quarter of a century of service I have never seen such an Utopian condition. And I doubt if anyone ever has or ever will. The controlling factor of any maintenance system is the supply of spare parts. In time of peace, the limitation of funds prevents the acquisition of spare parts in sufficient qualities and varieties to provide even our limited maintenance facilities with all of those parts which they want and most of which they need. In time of war, while funds may be unlimited, the availability of spare parts is limited. And the urgency with which these limited spare parts are needed in critical places prevents their dissemination throughout the numerous maintenance facilities which will then exist. In replying to that argument, the point frequently is raised that in some manner of means, one may procure the desired spare parts. That may be true in view of the excellent rustling characteristics of the average American soldier. But it is also true that such seeking of spare parts requires time. And it is more true, though it is frequently overlooked, that time is the only element for which there is no satisfactory substitute and which, not infrequently, is the most important element in war.

IT recently has been advocated that the maintenance functions of Ordnance personnel should be limited to repairs on strictly Ordnance matériel regardless of the requirements and demands which may be placed upon the organization. In that connection, I would like to recall that the well-known Westervelt Caliber Board recommended (and its recommendations were approved) to the effect that the Ordnance Department maintain all automotive matériel in the possession of artillery organizations. While the War Department approval of that recommendation is not now enforced, so far as I know it has never been revoked. At the 1935 Army maneuvers at Pine Camp, N. Y., an Infantry officer acting as an observer for the Second Corps Area, expressed the opinion that "the Ordnance Department should be expanded and equipped to take over the mission of automotive maintenance with reference to combat vehicles, including automotive prime movers of combat weapons within the army combat area." And he so recommended.

Careful consideration of the foregoing, leads one to the conclusion that facilities should be provided whereby broken parts can be repaired, improperly sized substitutes modified to fit, and some of the simpler parts actually manufactured. So the inclusion of machine tools, welding equipment, etc., in the equipment of an Ordnance maintenance company is clearly indicated.

With the machine-tool equipment, etc., as provided, the next question on which there is wide divergency of opinion is, how shall this equipment be operated—on the trucks or in the garages, machine shops, and other facilities which Leavenworth so readily assumes to be ever present? It is a policy of the Ordnance Department that machine-tool equipment transported in trucks as part of the equipment of an Ordnance maintenance company normally shall be operated in and on its transportation vehicles, but that it shall be so installed in the vehicles that in case of necessity or convenience it may easily be removed therefrom and operated in the aforesaid garages, machine shops, and other facilities. It is maintained by some that the machine-tool equipment should always be unloaded at the company bivouac in order to release the transportation for other purposes.

I raise the question as to whether the primary mission of an Ordnance maintenance company is to render effective Ordnance service or to operate its transportation more efficiently. The terms "efficiency" and "effectiveness" are not synonymous although they are frequently so used. Effectiveness of operation of a unit must not be sacrificed to gain efficiency of operation of some one particular item or group of items. Let us suppose that an Ordnance company has been rendered immobile by thus unloading its equipment and making its transportation available for some other purpose.

Let us further suppose that this transportation has been diverted to other purposes by competent orders and that, while the company is thus anchored to the ground, it receives orders or is otherwise compelled to make a sudden move. Without its transportation it cannot move. And no matter what may be the excuse for the absence of this transportation the necessary move cannot be effected. The commanding general will not be satisfied with alibis. What he wants is not alibis but accomplishments.

THE question is frequently raised by opponents of the machine-tool equipment as to how one can expect to operate such equipment in the front lines. Either I do not know what is meant by the front line or the questioners do not know how an Ordnance company normally operates. It is not expected that an Ordnance company will send its machine-shop trucks up to the firing line or into the trenches, or whatever else may constitute the front line. To the contrary, the Ordnance maintenance company establishes itself at a bivouac, the location of which has been selected by the Ordnance officer, recommended by him to the appropriate G-4, and by that officer approved. At this bivouac the company sets up what might be called its base echelon, which includes its machine-tool equipment, stock of spare parts, messing arrangements, etc.

From this bivouac as a base, in reply to calls for assistance, it sends out repair crews to all parts of the division area, using for the transportation of such groups, the light repair trucks which are provided. This employment of light repair trucks is the chief reason why the allowance of light repair trucks to maintenance organizations has been increased so materially within the last few years. If the unserviceable item can be repaired by that small repair crew at the place where it is found, it is then and there repaired. If it is impossible to repair this unserviceable item with the facilities and time available to these small repair crews, then the unserviceable item is brought back to the company bivouac, or base echelon, and there repaired by the use of the additional facilities of the company equipment. The work which the machine tools will be called upon to accomplish thus depends entirely upon the amount of work brought back by these numerous small crews operating from light repair trucks.

One of the aims of all the organization studies is to increase mobility. To effect this increased mobility by a mere reduction in the size of the columns, it is frequently suggested that all repair work and the greater part of the service troops, should be relegated to the corps. This suggestion is frequently recommended by Ordnance officers. This suggestion, however, fails to realize the relationship which exists in our present army set-up between the functions and responsibilities of the division, the corps and the army. This relationship is typically an American

military principle of military organization and should be preserved. This typical American principle provides that the corps shall have no supply and administrative functions except for its own troops. Thus, to attempt to impose upon the corps, service functions for its component divisions is to give to the corps a function and a responsibility which it never was and is not now intended to carry.

Increased mobility in army movements and operations is assured. It is maintained that this increased mobility will move repair and maintenance work farther into the rear. With this idea I am forced to disagree absolutely. It is my opinion that as mobility increases, demands will arise which will require that more and more maintenance work be done closer to the troops. A broken-down combat vehicle is as immobile as though it were rooted to the ground. I predict that such unserviceable equipment will most frequently be repaired where it has become unserviceable unless this place happens to be in the middle of the battlefield.

In the operation of mechanized forces, it is hard to conceive how such unserviceable combat vehicles may be hauled back to a base by some wrecking crew and, far in the rear, be repaired in comfort and leisure. It would appear that such unserviceable mechanized-force vehicles must be repaired with the mechanized force and kept up with the column or else abandoned, and its subsequent salvage intrusted to chance.

LET us now consider the problem of Ordnance service for aviation units, particularly the GHQ Air Force. The Air Corps is one of the arms of the Army. Like all other arms, in its operations it must be assisted by other arms and services so as to permit it to concentrate its maximum strength and effort on the accomplishment of its peculiar and assigned military missions. The question of Ordnance service is of particular importance because of the highly technical nature of Ordnance aviation matériel, the size and special problems of aviation ammunition supply, the vital necessity for adequate and uninterrupted Ordnance service, and the fact that without armament and ammunition, aviation becomes ineffective from a combat point of view.

When Air Corps units are incorporated in larger tactical units, as is now the case with corps and army aviation, it is evident that the necessary services for these Air Corps units must be rendered by the services belonging to those larger tactical organizations. When the Air Corps units are organized into a GHQ Air Force, it is evident that this Force, although organized for the performance of independent missions, will likewise require Ordnance service involving ammunition supply, maintenance functions, and general supply.

The GHQ Air Force at present is authorized to be organized into "highly mobile tactical units consisting only of such personnel and equipment as are essential for their self-sustained operation in the field for short periods of time" and mobile service squadrons capable of servicing and maintaining the combat units and taking over the administration, operation, and maintenance of a field other than the home station from which these combat units may be operated. In addition to these elements of the GHQ Air Force, there also is authorized for each of the several home stations, a station complement, not part of the GHQ Air Force, consisting of such service personnel as may be necessary to operate permanently the respective stations.

Since this authorization was first published, the Ordnance Department has held that the mobile service squadrons should be considered to consist not only of the army corps tactical units known as service squadrons, but also should include personnel from those services which are required for the operation of an Air Force when operating away from its permanent station. The experiences of the GHQ Air Force are leading to the development within aviation circles of support for that contention. It is now the opinion that the GHQ Air Force bears to the Air Corps somewhat the same relation that an Infantry division bears to the Infantry. Consequently, the requirements of the GHQ Air Force for Ordnance service are comparable to the requirements of an Infantry division for Ordnance service, which, as I have noted above, include maintenance, general supply, and ammunition supply services. The latest recommendation from the GHQ Air Force with reference to its improved organization contains provisions for the incorporation within its organization of service units from the several services of the Army.

THE Commanding General, GHQ Air Force, and the Chief of Ordnance are in general agreement as to the mission of Ordnance troops with GHQ Air Force units. As a result of conferences in February 1936, between a representative from the Office of the Chief of Ordnance and members of the Headquarters of the GHQ Air Force, agreement has been reached as to the responsibilities of the Ordnance Department with reference to Ordnance services to the GHQ Air Force. The conclusions reached at these conferences are as follows:

1. That it would be the responsibility of the Ordnance Department to receive bombs and ammunition and other ordnance material at railheads and load them on trucks to be operated by the Quartermaster Corps at that point.

2. That it would be the responsibility of the Quartermaster Corps to furnish truck transportation for all ordnance material from railheads to distributing points.

3. That it would be the responsibility of the Ordnance Department for handling ordnance material from trucks at distributing point, and from distributing point to the place of loading on airplanes; this responsibility to include uncrating, inspection, preparing bombs, ammunition, etc., for loading into the airplane.

4. That it would be the responsibility of the Ordnance Department to develop and provide handling equipment required for their responsibilities, including such items as tractors, tractors with cranes, trailers, etc.

5. That Ordnance companies would be organized on a basis which would provide platoons and sections suitable for accomplishing these functions, which could be detached from the company to Air Corps groups and smaller units as it required.

6. That the Ordnance organization would provide for such transportation as might be required for movement of Ordnance personnel, organization equipment, etc., within the base area, or from one base to another, in their Tables of Organization and Equipment.

The requirements for maintenance and general supply are governed absolutely by the variety and quantity of Ordnance equipment authorized for GHQ Air Force units. There are no differences of opinion between the GHQ Air Force and the Ordnance Department as to the degree of service required here.

As a result of the consideration of the foregoing facts, an organization was proposed to provide the necessary Ordnance service for these Air Force units. It was proposed that a platoon consisting of a headquarters section, a general supply section, an ammunition section and a maintenance section totaling, in time of peace, sixteen men, and in time of war, fifty men, be authorized for each GHQ Air Force group. The Commanding General, GHQ Air Force, recommended that several of these Ordnance service units be authorized for duty at several of the larger Air Corps fields. (On February 9th, 1937, the 10th Ordnance Service Company with headquarters at Langley Field, Va., was established. It is divided into six platoons to be located at six air bases in five states.—ED.)

There is general agreement as to what service shall be rendered by the Ordnance Department to the GHQ Air Force. There is not quite such general agreement as to exactly how these services shall be rendered, except while the units are on their permanent stations. Such difference of opinion as exists here is due entirely to the changing conception as to how the GHQ Air Force will operate away from its home stations. Until but recently, it was considered that aviation units could operate from any kind of a

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temporary airdrome whose chief consideration was primarily one of size.

Of late, however, the size and weight of bombers particularly have gone up to such figures as to make it impossible for such ships to land on and take off from unprepared fields, even though such fields may be of sufficient size. The requirement, then, for some sort of a prepared landing field seems to indicate that the GHQ Air Force will operate from its permanent home stations, such aviation bases as may be prepared under the authority of the Wilcox Bill, or from suitable commercial airdromes now in existence in rather generous numbers throughout the country. If this assumption is correct, it would seem that Ordnance service to aviation, no matter where it may be operating, will continue to be rendered in somewhat the same manner as now rendered at its home station. Such of these operating bases as I have enumerated above will have rail communication either actually to them or within a very short distance. Consequently, the problem of transportation is reduced to that which is comparable to post activities. Under those conditions, there is no reason why transportation cannot be handled through the medium of a transportation pool, as provided for in the agreements reached at the Langley conference.

THE authorization and creation of Ordnance service units of a mobile nature as a part of the mobile service organizations designed to accompany GHQ Air Force units in the field, does not eliminate the necessity for Ordnance sections in the station complements or base squadrons, as they probably will be termed. An Ordnance section in a station complement takes the place of the familiar post Ordnance detachments so common to the larger stations in the Army. The function of this detachment is to operate and maintain the service installations on the post, which are part and parcel of the permanent station installations regardless of the tactical units which may be stationed at or operating from the post in question. The same requirement exists at Air Corps stations and an Ordnance station of small size is being recommended in the base squadron for these purposes, regardless of what may be the organization of Ordnance service units for mobile Air Corps combat units.

One of the most difficult war-time problems with respect to GHQ Air Force units is the ammunition-supply problem involving the supply of bombs for bombardment elements. These bombs may be of such size that it is impossible to group around them a sufficient number of men to handle them. Consequently, bomb-handling machinery must be devised. This bomb-handling machinery involves, first, a crane type of machine capable of lifting a bomb up to 2000 pounds in weight from a flat car, or from a high-side gondola on top of a railroad embankment, to a truck; and secondly, some means for unloading a bomb up to a ton in weight, from a truck, and moving it on the air field to a suitable position for loading, beneath the bomber. Such machinery cannot be devised quickly upon mobilization, and yet it is absolutely essential to the effective combat operation of bombardment units. This equipment must be developed and should be accumulated in reasonable quantities during time of peace. Development of this equipment should be one of the functions of the Ordnance services, and the necessity for this development is one of the reasons why Ordnance service units for Air Corps units must be provided in time of peace.

It has been my good fortune to be associated rather closely with the development of Ordnance service for Air Corps units and the crystallization of the needs of the Air Corps for such service. It is my opinion that the problems involved are well on their way to a solution.

(This concludes Colonel Marsh's discussion of Field Service Problems. Part I was published in the May-June issue (p. 362), Part II in the July-August number (p. 43). In the November-December issue he will begin, in this department, a discussion of the duties and functions of the Corps Ordnance Officer.—Ed.)

Chronicle

THE act making appropriations for the military establishment for the fiscal year ending June 30, 1938, provides for an increase of 275 in commissioned personnel—175 additional Regular Army officers and 100 Air Corps Reserve officers to be employed on continuous active duty. The title "Chemical Warfare Service" is retained for that department and not changed to "Chemical Service" or "Chemical Corps" as requested by the War Department.* Eight hundred thousand dollars was specified for the procurement of mobile antiaircraft guns and mounts for seacoast defenses instead of $400,000 proposed by the Senate. The appropriation for the Organized Reserves was $9,837,883 and $4,119,570 for the Reserve Officers' Training Corps. The bill also provides the following amounts for work authorized by the act of August 12, 1935: At Bolling Field, D. C., $746,000; at Northwestern Air Base, Wash., $625,000; at Albrook Field, Panama Canal Zone, $717,000; at Hickam Field, Hawaii, $3,250,000; at the Air Corps Depot, Sacramento, Calif., $3,000,000; at Langley Field, Va., $338,000; at Barksdale Field, La., $80,000; at Edgewood Arsenal, Md., $854,000; at Fort Niagara, N. Y., $54,000; at Camp Stanley, Tex., $578,050; and at Savanna (Ill.) Ordnance Depot, $861,190. The bill carries total appropriations of $415,269,154—approximately $24,500,000 more than the appropriations for the fiscal year 1937, and $1,019,930 below the budget estimates for 1938.

An experiment of far-reaching military importance will be made during September and October when the new Infantry division organization, which has been under study for about a year and a half, will be tested at the 2nd Division maneuvers in Texas. The purpose of the new organization is to economize man power and increase fire power. Overhead, and command and supply echelons will be reduced, while the fire power of the unit will be increased to the maximum by the use of modern weapons. It is proposed to reduce the division from its war-time strength of 22,000 men to about 12,000 without decreasing its fire power.

GEN. JOHN J. PERSHING, chairman of the American Battle Monuments Commission, headed the United States delegation at the series of dedications of national World War memorials in Europe this summer. By invitation of General Pershing, Brig. Gen. Benedict Crowell, president of the Army Ordnance Association and World War Assistant Secretary of War and Director of Munitions, was a member of the delegation. The principal ceremony was the dedication of the Meuse-Argonne memorial at Mountfaucon, France, on August 1st. The schedule of ceremonies follows: August 1st, Mountfaucon; August 2nd, Montsec, France; August 3rd, Sommepy, France; August 5th, Tours, France; August 8th, chapel, Flanders Field Cemetery, Belgium; Audenarde, Belgium; Vierstraat, Belgium; August 9th, Bellicourt, France; Cantigny, France; August 12th, Brest, France; August 15th, chapel, Brookwood Cemetery, England. Gibraltar also was included in the dedication ceremonies. The monument at Chateau-Thierry will be dedicated early in October on the occasion of the American Legion's pilgrimage to France.

Eight Ordnance officers were among the fifty-eight graduates of the Army Industrial College, Washington, D. C., last June. Col. Harry B. Jordan, Ord. Dept., director of the college, gave an introductory talk; the principal address was delivered by Adm. William D. Leahy, Chief of Naval Operations. The follow-

*On July 22nd the Senate concurred in an amendment of the House of Representatives to the bill (S. 1284) to change the name of the Chemical Warfare Service to the Chemical Corps. The bill was vetoed August 4th.

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ing Ordnance officers received diplomas: Col. Alexander J. Stuart, Capts. Ralph H. Bassett, Waldemar S. Broberg, Richard C. Coupland, Franklin Mitchell, William F. Sadtler, and 1st Lieuts. Joseph M. Colby and John H. Hinrichs.

THE Douglas Aircraft Company, Santa Monica, Calif., has been awarded War Department contracts for 177 2-engine bombardment airplanes costing approximately $11,651,948. This is the largest peace-time airplane contract ever awarded. The award includes spare parts but not motors. When delivery of the bombers begins, orders will be given by the War Department to the Wright Aëronautical Company for 354 motors at $9000 each. This bomber contract brought the Douglas Company's unfilled orders to $38,031,828. Equipped to manufacture aircraft at an annual rate of $18,000,000, the company can operate at capacity for the next two years without additional orders. Ten thousand workers will be employed in meeting these demands. Boeing and North American Aviation have unfilled orders of approximately nine million and six million dollars, respectively.

After sixty-seven years of gathering weather data, the meteorological service has been transferred from the jurisdiction of the Signal Corps to that of the Air Corps. The transfer was prompted by a demand from the Air Corps for a more complete weather service than the Signal Corps was physically prepared to give. Such service includes 24-hour weather reporting to provide for GHQ Air Force night flying. The Signal Corps will retain responsibility for research and development, procurement, storage, and issue of equipment.

The House Committee on Military Affairs has reported favorably the bill providing for the exportation of helium gas, under the direction of the President, to foreign countries for medical purposes and for use in commercial airships. Comdr. Charles E. Rosendahl, speaking before the committee, disagreed with the opinion of Dr. Hugo Eckener relative to the war-time value of dirigibles, stating that, in his opinion, airships would be valuable in war as airplane carriers and for scouting purposes.

In accordance with the President's wish for a 10-per-cent cut in governmental expenditures, budgetary officials of the armed forces are working on plans to save as much as possible of their 1938 appropriations. However, as the President announced that he did not think the full 10-per-cent reduction could be effected in the armed services, there was hope that a harmful reduction in expenditures for these purposes would not be necessary.

Ten officers were graduated from the Ordnance School at exercises held last June in the post auditorium of the Aberdeen Proving Ground. Maj. Gen. William H. Tschappat, Chief of Ordnance, addressing the class, pointed out the growing task of the Ordnance Department in the development, manufacture, and supply of new types of ordnance and the responsible positions held by young officers in carrying out this task. The graduates were: First Lieutenants John A. Barclay, Jr., F.A.; Lawrence A. Bosworth, C.A.C.; William A. Call, C.A.C.; Ferdinand M. Humphries, C.A.C.; Russell R. Klanderman, Inf.; William L. McCulla, C.A.C.; John A. Meeks, F.A.; Elmo C. Mitchell, C.A.C.; Wilbur M. Skidmore, C.A.C.; and John S. Walker, F.A.

THOUSANDS of acres of land were leased for the Fourth Army maneuvers held in August, marking the first time since the World War that private land had been called into extensive use in the Fourth Army area. Nearly fifty-six thousand men were mobilized at the four concentration points—San Luis Obispo, Calif.; Fort Lewis, Wash.; Camp Ripley, Minn.; and Fort Riley, Kans. This area of operations offered terrain of a very diversified nature—ranging from woodlands to rolling meadows.

Adm. W. D. Leahy, U.S.N., Acting Secretary of the Navy, announced July 31st that the Navy will coöperate with the Navy League of the United States in the observance of Navy Day on October 27, 1937, the anniversary of Theodore Roosevelt's birth.

Book Reviews

CHEMICALS IN WAR. By Augustin M. Prentiss, Lieutenant Colonel, C.W.S., and George J. B. Fisher, Major, C.W.S. New York: McGraw-Hill Book Company. 1937. $7.50.

TO THE man in the street, chemical warfare had its inception when the Germans preceded their attack on Ypres in the late afternoon of April 22, 1915, by a cloud of chlorine gas released from cylinders. But smoke is just as much a part of chemical warfare as poison gas, and history reveals that in 1700 King Charles XII of Sweden crossed the Dvina River in the face of opposing Polish-Saxon forces under cover of a smoke screen generated by the burning of masses of damp straw. And fire, which made its appearance in the World War in the form of the dreaded flamethrowers, has been used since early Biblical times, the first flamethrower having been used in 424 B.C. at Delium. In 1864, a British writer urged the use of toxic gas in war as being so merciful, yet so effective, that its universal and widespread use would eventually cause wars to cease.

And how many of us realize that while 26.75 per cent of the American Army's casualties in the World War were gas cases, only 2 per cent of the gas cases died, while the deaths among the nongas casualties were more than 25 per cent?

The authors present their subject in five parts. The first part covers fundamental considerations and includes basic principles, technical and tactical requirements, means and methods of the dissemination of chemical agents, military organization for chemical combat, and a brief résumé of the development of this organization. Part II is devoted to a very complete description of chemical agents, written in easily understood language, accompanied by numerous formulas and lightened by accounts of historical uses of the several gases and opinions as to their future employment. Part III presents in great detail the technique and tactics of chemical warfare for infantry, cavalry, chemical troops, artillery, and aviation. Part IV describes the defense against chemical attacks and discusses individual, collective, and tactical protection, and also the protection of civil populations. Part V takes up general considerations, and under this heading the authors show the relation between chemical industry and chemical warfare, the effectiveness of chemical warfare, and the status of attempts to regulate this type of warfare by international agreement from the first Hague conference down to the present time. In the last chapter the authors reach the conclusion that "while chemical combat immensely complicates modern war, it is susceptible to complete and adequate defense, and protection against it is essentially a matter of scientific skill. The chemical war of the future will, therefore, be primarily a contest between the scientific abilities of the combatants; *i.e.*, a contest of brains and not brawn. This simple fact holds out the greatest hope for the future of civilization, for the destiny of man is safest in the hands of the most intelligent."

Pacifists who fear and newspaper writers who picture the gassing of whole cities would do well to read what these authoritative writers have to say on that subject. To obtain a lethal concentration for any extended period of time by means of bombs dropped from airplanes would require one 300-pound bomb for each circular area 200 yards in diameter. Spraying the chemicals requires that the plane fly not more than 300 feet high, and then the gas must be sprayed directly on exposed personnel; and, in general, 10 pounds of liquid chemical agents per 100 square yards are required for worth-while results. Does the gassing of New York or Pumpkin Center appear to be a near possibility? R. M.

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SOUND WAVES—THEIR SHAPE AND SPEED. By Dayton Clarence Miller. New York: The Macmillan Company. 1937. $2.75.

DR. MILLER is professor of physics at Case School of Applied Science. He is also the author of "The Science of Musical Sounds" and "Anecdotal History of the Science of Sound." In 1918 and 1919 he organized and carried out at the Sandy Hook Proving Ground an extended series of experiments on the pressure developed in the sound waves produced by the discharge of large guns and for the determination of the velocity of the explosive sounds and of the normal velocity of sound in free air.

Part I of the present volume includes four chapters relating to sound and tone quality; the phonodeik—an instrument which makes possible the making of a photographic record of a sound wave of such size, definiteness and accuracy of outline, that the quantitative study of surveys having components of small magnitude and high frequency is feasible; the shapes of sound waves; and electric-spark photography of sound waves.

Part II is a detailed narrative of experiments conducted at the Sandy Hook Proving Ground during and immediately following the World War on the pressure, wave form, and velocity of sounds from large guns. The theory and equipment used to determine the pressure effects on the air near large guns in action is described fully. There are ample data descriptive of the wave form of the sounds from large guns and of the measurement of propagation of the sound wave from the muzzle. These data have not been published before, and although they describe experiments of nearly twenty years ago their availability is of great value to the ordnance engineer.

The volume is profusely illustrated. The Chief of Ordnance of the Army gave his approval to the author of the free use of all the data obtained at the Proving Ground and in addition provided certain photographs which were reproduced.

ARMY ORDNANCE some years ago published articles from the pen of the late Philip P. Quayle who studied under Dr. Miller. Mr. Quayle's work as a pioneer in the science of spark photography was acknowledged by the *Journal of the Franklin Institute* and the United States Bureau of Standards. All students of ordnance will be grateful to Dr. Miller for his researches and leadership in a fascinating field of ordnance engineering. They will join in this reviewer's praise not only for the research involved but for the clarity and completeness of Dr. Miller's treatment of the subject. O. E. D.

OUR GALLANT MADNESS. By Frederick Palmer. New York: Doubleday, Doran & Company, Inc. 1937.

OF ALL the war correspondents whom the United States has produced, there is, perhaps, no one better qualified by experience and past literary efforts to write a nontechnical, nonmilitary, and nonpolitical account of the American effort in the World War than Frederick Palmer. With the creation of the A.E.F., he became Chief of the Press Division of GHQ, attained the rank of colonel, and served throughout the war as an officer.

From the outbreak of the war in 1914 until our entry therein, frequent visits from the battlefields of France to the United States gave Colonel Palmer an unparalleled opportunity to observe the growth of the war spirit in the States and to see the effects of propaganda in molding our sympathies. Could we have kept out of the war, he asks, even if we overlook those influences of "human emotions rising to passion, the atavistic, sentimental, ethical trends and the traditional inheritances which shape the thought of a people, as well as their financial and economic interests"? He answers that question himself when he explains that there was only one way for us to remain permanently neutral and that way "was to keep out of European waters, make our own zone and leave the warring nations to fight it out in their zone, preventing all material for war from leaving our shores."

Of the war efforts of the United States, the visits of the several foreign missions, the early assurances that the Allies needed only our money and our materials, the suggestions that only a small body of American troops were needed in France to bolster the morale of a war-weary people, the devious ways by which the truth finally was learned as to the real conditions of the war, our determination to raise an army of millions, our training and matériel problems, the fight to retain American soldiers under the American flag, the battles of Cantigny, Soissons, St.-Mihiel and the Argonne, and all the other facts of American participation in the war are discussed by Colonel Palmer.

The part played by graduates of the United States Military Academy arouses Colonel Palmer's praise. He refers to them as "Sons of Sylvanus." Of Sylvanus Thayer, the father of the Military Academy, he says, "The shadow of Sylvanus Thayer was over the War Department's every working hour in the World War, over every headquarters in France, behind every salute and every bawling-out, whether rightly or wrongly given, with the unknown-soldier-to-be, in the trenches, up the slopes of the Meuse-Argonne, and on to the Rhine, possibly saving us from double the number of dead and maimed." R. M.

THE ARMOR OF GALIOT DE GENOUILHAC. By Stephen V. Grancsay. New York: The Metropolitan Museum of Art. 1937. $2.50.

THE armor of De Genouilhac is like the Whitworth gun: each is the handiwork of another age, a tribute to its designer, and an achievement unique in the period it represents. The Genouilhac armor is notable for the execution of detail and stands by comparison with the handiwork of other periods as a tribute to a genius who, were he alive today, undoubtedly would have produced an armored car of invincible characteristics.

Such material as the armor of Genouilhac is worthy of the fascinating study Mr. Grancsay has made of it. Surely no present-day student of the subject is better qualified than he to undertake the task. As curator of arms of the Metropolitan Museum of Art, Mr. Grancsay has accomplished a difficult work in bringing to a high state of perfection the study of an art in which other generations were more proficient than our own.

This book is beautiful in typography and illustration as befits the nature of the work. It is an exhaustive study of the construction, material and hardness, measurements and weights, and decoration of this sixteenth-century armor. Moreover, there is a comparison of the Genouilhac armor with that of Henry VIII and finally an historical attribution of the pieces studied. These were acquired by the Metropolitan Museum from the lineal descendants of the maker and until recently remained in the ducal château of Bonnelles. O. E. D.

WAR MEMOIRS OF DAVID LLOYD GEORGE, VOL. VI. Boston: Little, Brown & Company. 1937. $3.00.

THIS volume takes up the thread of the narrative of the author's earlier volumes with the Beauvais conference and the campaign of the north. He then discusses the controversy that arose as to the conditions that led to the March 1918 defeats and the part played by Sir Frederick Maurice in the attacks on the Government over those conditions. His next chapter deals with the German offensives of the early summer of 1918 and the passage of the Allies from the defense to the offense, culminating with the Armistice. He then discusses conditions in Eastern Europe after the signing of the Brest-Litovsk treaties and covers fully what was going on in the other theaters of operations during the spring and summer of 1918.

The longest chapter in the book describes how peace—or should I say, the Armistice?—came. This, in my opinion, is the best part of the book, not only because it covers that important period and its series of momentous conferences with the greatest authoritative detail, but also because it is less marred by his characteristic strictures on those who did not always agree with him.

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The remainder of the book contains accounts of the great educational reform which occurred in England during this distracting period, a refreshing discussion of the functions of governments and soldiers and the extent to which politicians—I note that he does not say statesmen and diplomats—should control military operations, the establishment of the fact that the war, as far as England was concerned, was fought by the British Empire as a whole, and, in conclusion, a rather caustic refutation and condemnation of Lord Haig's diaries. However, he defends himself against the condemnation that he has criticized every admiral and general by setting forth the names of some eighteen military and naval commanders whom he has praised. It may interest American readers to learn that he has lauded, among the great American commanders, only two—General Bliss and Admiral Sims.

Mr. Lloyd George is of the opinion that the war could have been averted, that it could not have been ended earlier by negotiations but that victory could have been achieved at an earlier date by better handling on either side of the resources at their disposal and the opportunities open to them. He maintains that "in 1915 the Allies committed the grave strategical error of concentrating their strength on a tremendous offensive against the German ramparts in France, and thus allowing the Central Powers with a few divisions to conquer the Balkans. But this mistake was more than counterbalanced by the incredible blunder committed by the German Staff in the spring and summer of 1916 when they hurled their best legions against Verdun in a vain effort to capture it. The Allied mistake prolonged the war. The German mistake lost them the war." R. M.

VIEWED WITHOUT ALARM. By Walter Millis. Boston, Mass.: Houghton Mifflin Company. 1937. $1.25.

THIS little book—only seventy-nine pages long—is the result of a trip to Europe which Mr. Millis, author of "The Road to War," made in the fall of 1936. When he left the United States, the author says, "it was with some faint doubt as to whether I might not be engulfed in a world war before I returned. When I came back it was with a sense that such fears could be exaggerated. The dictators, the diplomatics, and the wars are real and terrible enough, but one sees them on the ground through certain homelier perspectives that, also, may not be without their importance." And so this book "is an effort, merely, to fill out with a traveler's direct impressions something of the color and mental climate of the contemporary Europe that lies behind the daily dispatches."

Mr. Millis found that military preparations and military fears were universal in all the principal capitals which he visited, and that talk of the next world war was a "wearisome commonplace" but he arrived at the conclusions that such a war, while always a possibility in Europe, was somewhat remote because, as he phrased it, "the British have decided simply that they will not fight; the French cannot; the Germans are not ready even if they actually wished to risk it; the Russians have no reason to start a war."

Should such a war start, however, Mr. Millis does not believe that it will be a conflict between Communism and Fascism but between dictatorship and democracy. The capital of the European forces of democracy is London—the London where "the old established machinery of strictly parliamentary government turned solemnly" despite the Fascist riots which had raged in its own East End. The other European capital is unquestionably Moscow. Paris is still Paris, but momentarily paralyzed. And Berlin, a third-rate architectural copy of Paris, is distinctly a third-rate economic, social, and political model of Moscow. The author describes Moscow as an "incredibly poverty-stricken, half-finished, self-conscious, and overgrown provincial city," but if Europe's future is to be bound up with dictators, Mr. Millis is convinced that "it is Moscow one must salute as the true capital of Europe's future." R. M.

THE NEW INTERNATIONAL YEAR BOOK. Edited by Frank H. Vizetelly. New York: Funk & Wagnalls Company. 1937. $6.25.

THE 1937 issue of the New International Year Book is on a par with its thirty-four predecessors. Which is to say that it presents its comprehensive narrative of the past year with the factual completeness and circumspection for which this annual volume is noted. Under the brilliant editorship of Doctor Vizetelly, assisted by a noted staff of contributors, the entire range of human affairs is cataloged and described. As in former years, the article on military progress is again by Brig. Gen. John J. Bradley. The article on naval progress is the work of Comdr. C. H. McMorris, former editor of the *Proceedings of the United States Naval Institute*. In particular, these contributions give the high lights of military and naval progress of the United States and the principal foreign nations. Their thoroughness of treatment is characteristic of the standard achieved in the hundreds of topics discussed which range from Abyssinia to Zululand. The well-informed student will find this volume indispensable. O. E. D.

THE MARCH OF CHEMISTRY. By A. Frederick Collins. Philadelphia: J. P. Lippincott Company. $3.00.

MR. COLLINS is the author of some thirty books ranging from the encyclopedic "New World of Science" to boys' and girls' books on games, including books on optics, chemistry, electricity, radio, television, astronomy, and aviation. It is not to be wondered, then, that this book is more than just a bird's-eye view of the marvels of modern chemistry. It correlates these marvels with the many other scientific and technical fields of activity with which so many of them are closely connected and applied.

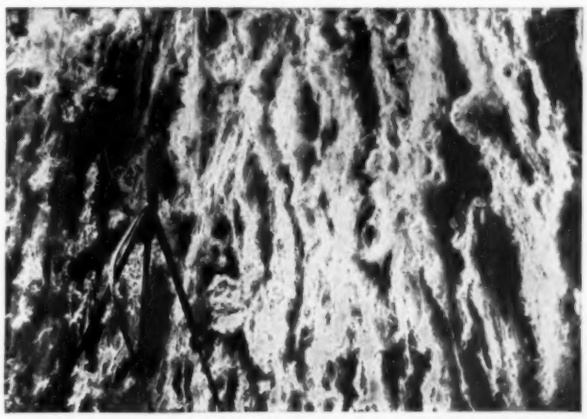
Quoting Mr. Collins, "In the long romance of chemistry there have never been so many new, startling, and useful discoveries made as in the past few years. and in this time the superchemists of the private, collegiate, and industrial laboratories of the world have brought forth the most amazing and revolutionary array of elements, compounds and processes imaginable." The author then proceeds to tell us in plain, understandable, nontechnical language what these new "elements, compounds, and processes" are. A summary of the chapter titles shows how comprehensive this account is: "New Inorganic Compounds," "New Methods and Apparatus," "New Organic Compounds," "New Radioactive Substances," "Some New Heat Producers," "Some New Cold Producers," "The New Chemistry of Photography," "New Electrochemical Processes," "New Synthetic Products," "New Metals and Alloys," "New Explosives and War Gases," "New Biochemical Discoveries," and "The New World of Agriculture."

To mention just a few of the outstanding accounts in this book, the discussion of new synthetic compounds ranges from dyes to diamonds; the chapter on war gases very effectually debunks the common newspaper accounts of future destruction of whole cities by aërially distributed poisons; the daily references to enzymes, vitamins and hormones are made plain by the recital of the new biochemical discoveries; and the chapter on new electrochemical processes covers electroplating with chromium and all of the more recently discovered metals, and even the new art of electroplating with rubber.

I am sure the public has been waiting a long time to be informed in this manner on so vital a subject. R. M.

DIELECTRIC PHENOMENA IN HIGH VOLTAGE CABLES. By D. M. Robinson. Pittsburgh: Instruments Publishing Company. $5.00.

THIS is the third volume of the series of monographs on electrical engineering under the editorship of H. P. Young. Five other volumes are in preparation. In this present study, detailed attention is given to the characteristics of electric cables arising from problems incident to the cylindrical form of the condenser, the lengths involved and a number of other factors. Some of the



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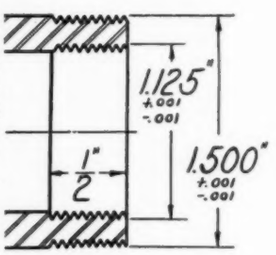

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most recent and revolutionary discoveries of the few scientists who have specialized in this direction are set out with forceful clarity by Dr. Robinson.

This book should be of particular concern to the student of cable manufacturing technique as well as to the users of industrial equipment which in growing degree depends upon the proper capacity and conductivity of the cable medium. Much of the material was furnished by Callender's Cable and Construction Company, particularly those portions on void-formations, barrier action and surface stress, little of which has been published previously. Ample description is also devoted to the technique of testing and examination and the problem of tracking. We commend this volume to all electrical engineers. O. E. D.

SAGITTARIUS RISING. By Cecil Lewis. New York: Harcourt, Brace & Co.

ON the jacket of this book is printed, "This is the story of an aviator who had one of the most spectacular careers in the war. He joined the R.F.C. when he was technically under the age limit, was commissioned on December 29, 1915, and retired after the Armistice with the rank of senior flight commander at the age of 20. Thereafter he went to China for two years to teach the Chinese to fly. Looking back on his experiences from the vantage of two decades, Cecil Lewis gives a picture of the war in the air such as no other writer has given. Its reckless courage, its romance, its futility, fall at last into perspective. Fused by Lewis's singular gifts as a writer, this is a book not only of high adventure, but of poetry and wisdom." If brevity be the soul of wit, then this is a witty review of this book, a review with every word of which I agree.

Mr. Lewis was an aviator for almost three years during the war. As such, he had all the experiences that befell the lot of any pilot, but with this difference—he lived to write about them twenty years after. However, it is not the mere recital of his varied experiences, interesting though they may be, that constitutes the charm and appeal of this book. It is the phrasing of his impressions, the things he saw from the sky, the sentiments and emotions that all of us feel but are unable to express—these are the things that make this book so fascinating. R. M.

SWISH OF THE KRIS. By Vic Hurley. New York: E. P. Dutton & Co., Inc.

WITH the independence of the Philippine Islands still a debatable question of American policy—recent Congressional action notwithstanding—this work is most timely. Mr. Hurley in this, his latest book on the Moros and their lands and seas, not only gives us the results of years of research on Moro history, but he gives us his opinion as to the possible Moro-Filipino relations under Philippine independence—an opinion which is based on years of living among those warlike Mohammedans.

Where the Moro came from cannot be established with certainty, but it is evident that they were part of that "confused scramble of races flowing eastward out of Asia" which invaded the islands of the western Pacific about the dawn of the Christian era. The next thousand years were punctuated by wars between the races of this theater of human existence. As the author pithily puts it, "The white men were incidents. In most cases the white men were accidents." At the end of fifteen centuries of Moro occupation they were firmly established in Sulu and Mindanao and had extended their sphere of influence to include Luzon and the northern islands of the Philippines.

Mohammedan missionaries came to these islands about 1400 and found a receptive people. Probably the martial aspects of the Mohammedan faith and teachings had a strong appeal to these Moros who had a history of fifteen centuries of successful combat behind them.

Although the Spaniards came within a hundred years after the Mohammedan missionaries, and although by the end of the sixteenth century the northern islands had been conquered, and

subjected to taxation, tribute and forced labor, the Moslems of Mindanao and Sulu were still unbowed before the Spanish invasion. In fact, the Moro capital on Jolo never held a permanent Spanish garrison until 1876 although it had been assaulted sixteen times from 1578. For over three centuries the Spanish tried in vain to conquer these Moros and they probably heaved a hearty sigh of relief when, in 1898, the Americans took over the job of civilizing these people.

Mr. Hurley brings his fascinating account to a close with a discussion of the serious problem which will confront the Filipino nation when they begin to rule—or shall I say, attempt to rule?—the Moros. "The Moro is poised at a crossroad. He can accept the peace that the Filipino offers, or he can with equal facility pick up the bloody kris which he dropped at the Battle of Bagsak." He attempts no prophecies but certainly if the light of the past is any guide to the future, a long path of trouble and grief is in store for the Filipino régime unless they exhibit unusual tact, toleration, and fair treatment for their Moro minorities. R. M.

PAMPHLETS RECEIVED

WE OR THEY—TWO WORLDS IN CONFLICT. By Hamilton Fish Armstrong. New York: The Macmillan Company. 1937. A summary of the issues at stake in the struggle of democracy against dictatorship, as seen by the author. An idealistic discussion which is rather hard on Messrs. Mussolini and Hitler but not so tough on Mr. Stalin. Senator Nye's Committee was "amateurish and surprising in its dearth of surprises." The League of Nations, in Mr. Armstrong's views, is still the main way out.

AMERICAN INDUSTRY AND OUR NATIONAL DEFENSE. By L. A. Codd. Princeton, N. J.: Princeton University Press. 1937. An address delivered by the editor of ARMY ORDNANCE before Princeton University on January 12, 1937, in the Cyrus Fogg Brackett Lectureship in applied engineering and technology.

THE UNITED STATES NAVY. By Senator David I. Walsh, Chairman of the Senate Naval Affairs Committee, with the assistance and coöperation of the Navy Department. Superintendent of Documents. Washington, D. C. 10 cents. A 70-page history and narrative of the "first line of defense."

PERSONNEL ADMINISTRATION IN THE FEDERAL SERVICE. The President's Committee on Administrative Management. U. S. Government Printing Office. 20 cents. This is the first of a series of studies on administrative management in the Government of the United States. The text is by Floyd W. Reeves and Paul T. David. The analysis includes a résumé of Federal personnel administration today; proposals for the development of a suggestion of personnel administration; and the extension of the merit system.

GOVERNORS ISLAND, 1637-1937. Governors Island Club, N. Y. A history of the Army's premier military post. Produced for the tercentenary celebration (June 13, 1937) of the purchase of Governors Island in 1637 by Nouter van Twiller from the Indians. Compiled in the Office of the Assistant Chief of Staff G-2, Hq. Second Corps Area, under direction of Maj. R. Ernest Dupuy.

THE CAVALCADE OF DIESEL. By John B. Kennedy. Peoria, Ill.: Caterpillar Tractor Co. A description of Diesel-engine development and manufacturing facilities with a brief indication of Diesel-engine possibilities.

A REVIEW OF THE ORGANIZATION AND OPERATIONS OF THE GUARDIA NATIONAL DE NICARAGUA. Published by direction of the Major General Commandant of the U. S. Marine Corps. A general outline of the accomplishments, organization, military operations, and public relations of the Guardia under the command of the officers and men of the U. S. Marine Corps and Navy from 1927 to 1933 with complete texts of principal correspondence, regulations, and statistics, and a complete chronological narrative.

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